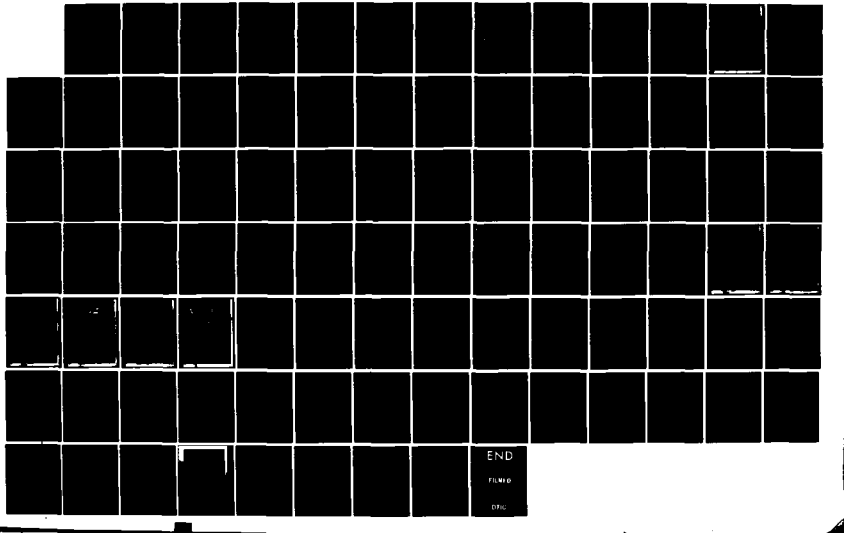
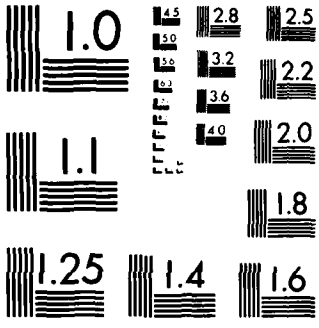
AD-A154 691 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS SEBAGO LAKE DAM (ME-0.. (U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV SEP 78 1/1

UNCLASSIFIED F/G 13/13 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

PHOTOGRAPH THIS SHEET

AD-A154 691

DTIC ACCESSION NUMBER

II

LEVEL

1

INVENTORY

ME-00071

DOCUMENT IDENTIFICATION

Sep 1978

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

DISTRIBUTION STATEMENT

ACCESSION FOR	
NTIS	GRA&I
DTIC	TAB
UNANNOUNCED	
JUSTIFICATION	
BY	
DISTRIBUTION /	
AVAILABILITY CODES	
DIST	AVAIL AND/OR SPECIAL
A-1	

DISTRIBUTION STAMP

DTIC ELECTE
JUN 7 1985
S D

DATE ACCESSIONED

DATE RETURNED

85 6 7 152

DATE RECEIVED IN DTIC

REGISTERED OR CERTIFIED NO.

PHOTOGRAPH THIS SHEET AND RETURN TO DTIC-DDAC

DTIC FORM 70A DEC 83

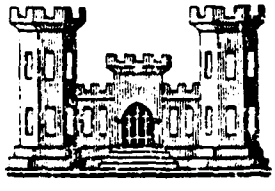
DOCUMENT PROCESSING SHEET

PREVIOUS EDITION MAY BE USED UNTIL STOCK IS EXHAUSTED.

PRESUMPSCOT RIVER BASIN
WINDHAM, MAINE

SEBAGO LAKE DAM
ME-00071

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

SEPTEMBER 1978

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ME 00071	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Sebago Lake Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE September 1978 13. NUMBER OF PAGES 55
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

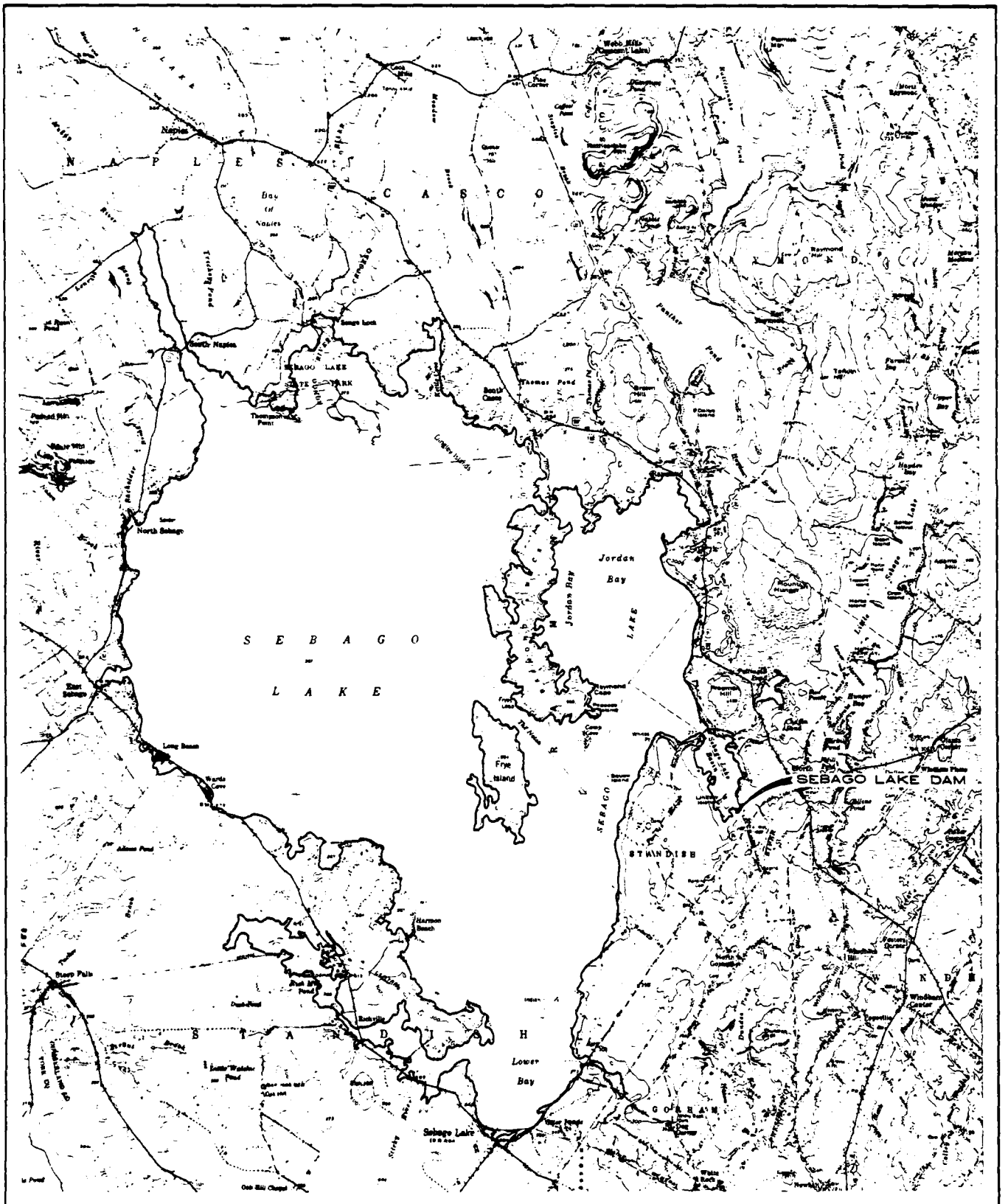
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,
Presumpscot River Basin
Windham, Maine
Presumpscot River

20 ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is a stone gravity dam. It has an earth embankment and stone masonry wing walls. It is about 25 ft. high and is about 1000 ft. long in overall length. The dam is judged to be in good condition. There are no areas of major concern regarding the long term safety of the dam. It is large in size with a high hazard potential. There are various remedial measures which should be undertaken by the owner to enhance the long term integrity of the structure.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE



NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

SEBAGO LAKE DAM
LOCATION MAP

PRESUMPSCOT RIVER MAINE

SCALE AS SHOWN

DATE SEPTEMBER 1978

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

ME-00071

SEBAGO LAKE DAM

WINDHAM-STANDISH

CUMBERLAND COUNTY, MAINE

PRESUMPSCOT RIVER

July 27, 1978

BRIEF ASSESSMENT

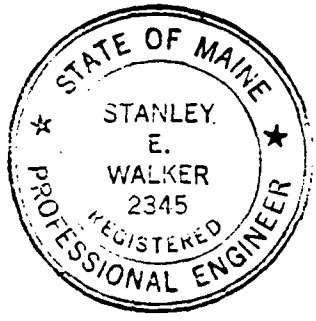
The Sebago Lake Dam is a stone masonry gravity dam. It has earth embankment and stone masonry wing walls. The dam is about 25 feet high and about 1000 feet long in overall length.

Based on the visual inspection, available drawings, and reports of past operational performance, the Sebago Lake Dam is judged to be in good condition. There are no areas of major concern regarding the long term safety of the dam.

Based on its large size and high hazard classification in accordance with the Corps of Engineers' guidelines the test flood is the maximum probable flood (MPF). The spillway will pass only about 25 percent of the MPF test flood and is considered inadequate. The dam will pass approximately a 200-year flood without overtopping. Should overtopping of the structure occur, failure due to erosion would likely result in the earth embankment portion of the north wing wall.

Several items of remedial maintenance, as outlined in Section 7 of this report, should be implemented to enhance the long term integrity of the structure. Major maintenance items include cutting trees and brush, work on the old canal lock, and filling and stabilizing areas of erosion. The maintenance actions outlined in Section 7 should be implemented within 2 years after receipt of this report by the owner.

It is also recommended that a definite plan for around-the-clock surveillance be implemented for periods of unusually heavy runoff and a formal warning system be developed for use should an emergency develop.



EDWARD C. JORDAN CO., INC.

Stanley E. Walker, P.E.
Project Manager

This Phase I Inspection Report on Sebago Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway test flood is based on the estimated "Maximum Probable Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

SECTION 5 - HYDRAULIC/HYDROLOGIC

SECTION 6 - STRUCTURAL STABILITY

ECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

APPENDICES

SEGABO LAKE DAM

ME-00071

PRESUMPSCOT RIVER BASIN

WINDHAM, MAINE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

c. Visual Inspection. The outlet of Sebago Lake is controlled by Sebago Lake Dam, which is a cut stone masonry dam with earth embankment dikes at the northerly and southerly ends. Outflow from the dam is able to pass into two channels, the Eel Weir Canal and the Presumpscot River. At high tailwater in the canal, flow overtops the Eel Weir and travels immediately into the Presumpscot River just below Sebago Lake Dam. The canal is regular in shape with overhanging trees on its embankments, and the river channel is rocky with overhanging trees on its embankments. The regulated outlets on the canal side and on the river side of dam were operational.

d. Overtopping Potential. The hazard potential was determined by examining downstream areas for possible damage. The failure analysis assumes a breaching of the dam at full spillway capacity. "Rule of thumb" guidance for estimating downstream dam failure hydrographs are described in an attachment to ETL 1110-2-234 and was used as an aid in this analysis. According to the criteria outlined in this "rule of thumb" method, the breach width should not be greater than 40 percent of the width of the dam. This criteria produces a breach width which is narrower than the opening at Whites Bridge upstream from Sebago Lake Dam. Therefore, Whites Bridge would not appear to be a substantial constriction. The cursory analysis of flood wave heights downstream of the dam showed that there is not any substantial valley storage between the dam and the city of Westbrook. According to a draft flood study just completed by the Corps of Engineers, the 500 year frequency flood flow ranges from 17,000 cfs to 18,600 cfs in Westbrook, which is roughly equivalent to the peak flow produced from a breaching of the Sebago Lake Dam. The triangular hydrograph that was constructed for the breaching of the Sebago Lake Dam has a peak of 22,300 cfs and it does not reduce to 17,000 cfs until about the fourth day after the breaching takes place. Therefore, the 500 year flood plain may be representative of the extent of flooding for the downstream areas of Sebago Lake

SECTION 5

HYDRAULIC/HYDROLOGIC

.1 EVALUATION OF FEATURES

a. Design Data. Design data was not available for the Sebago Lake Dam.

b. Experience Data. There is a USGS gaging station (No. 01064000) located about 1 mile downstream of the Sebago Lake Dam. From data recorded at this gage a log-Pearson Type III statistical analysis was furnished by the USGS. The following is a table of flood discharges from Sebago Lake Dam.

Recurrence Interval, (Years)	Flow, (cfs)
10	2,700
25	3,823
50	4,870
100	6,126
200	7,635
500	10,100

A review of lake levels for Sebago Lake shows that Sebago Lake has been above legal high water elevation (267.15 feet) several times during this century.

Flood Date	Recorded Water Surface Elevation	Recorded Outflow, (cfs)
1902	267.7	7,000[1]
1922	267.5	3,200
1928	267.3	2,370
1936	268.1	3,790
1951	267.0	3,160
1952	267.1	3,620
1953	267.1	3,420
1960	267.1	3,420

[1]Dam failure occurred during the flood of 1902.

SECTION 4

OPERATING PROCEDURES

4.1 PROCEDURES

The canal gates are operated to maintain sufficient flow in the canal to supply Eel Weir Power Station with water for its hydroelectric turbines. The river gates are operated to pass flood flows into the Presumpscot River. Both gates are housed and the gate buildings are locked. The spillway is an emergency spillway and has no provision for flashboards.

4.2 MAINTENANCE OF DAM

Maintenance to the dam is done on an as-needed basis. The dam is maintained in good condition. Frequent inspections are reportedly made by S.D. Warren Company personnel to detect vandalism and other forms of deterioration and to make necessary repairs.

4.3 MAINTENANCE OF OPERATING FACILITIES

The gates and gate operating machinery appear to be in good repair, except the river gate motor which is dirty. No scheduled maintenance program is, however, in effect.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

No warning system is known to be in effect.

4.5 EVALUATION

The Sebago Lake Dam and its appurtenant structures are in fair to good repair. Although no regularly scheduled program of maintenance is in effect, S.D. Warren Company personnel reportedly are frequently at the dam to check vandalism and to make necessary repairs. No formal warning system for either high water or structural distress is in effect at the dam.

or erosion was evident. The dike has only 2 to 3 feet of freeboard and is not specifically protected from erosion, however overtopping is unlikely since the canal weir acts as a spillway under high flows. No serious erosion was noted. Some rodent holes exist in the dike.

d. Reservoir Area. The outlet from Sebago Lake is controlled by Sebago Lake Dam which is a cut stone masonry dam. About 100 feet upstream of the river gates is an abandoned coffer dam at approximately elevation 257.2 feet, about 6 feet below normal water surface elevation. About 100 feet upstream of the canal gates is a fish screen which is approximately 90 feet in length. The shore line is generally wooded with many cottages and year round residences situated on it. See photograph 6.

e. Downstream Channel. The downstream channel is formed by the Eel Weir Canal and the Presumpscot River which join approximately 1 1/4 miles downstream. The canal is regular in shape with some overhanging trees. The river channel is rocky with wooded overbanks.

3.2 EVALUATION

Based on visual inspection, the dam appears to be in good structural and mechanical condition. The Eel Weir timber spillway and dike are also in reasonably good condition. As outlined in Section 7, some maintenance of the facilities is necessary.

Seepage was also observed along the toe of the downstream masonry wall of the north wing wall of the dam. In two areas, see plan, springs have developed and moderate seepage (probably less than 10 gpm) is occurring.

(d) The timber gate in the old canal lock located in the southerly portion of the dam is badly deteriorated. Earth fill has been placed upstream of the old canal lock but the gate is in effect acting as a retaining structure (photograph 11).

(e) There are remains of old sluiceway support timbers located in the masonry face of the spillway portion of the dam. This timber is deteriorating.

(2) Hydraulics - At the time of the visual inspection, July 27, 1978, the lake level was at approximately 265.2 feet, about 1.5 feet below spillway crest. Both the canal gates and river gates operated satisfactorily. The river gates had some leakage when closed, as shown in overview photograph. About 100 feet upstream of the canal gates is a trash rack which is 90 feet long. About 100 feet upstream of the river gates is an abandoned coffer dam at approximately elevation 257.2 feet. About 1 1/4 miles upstream of the Sebago Lake Dam is Whites Bridge which would likely act as a constriction at very high flows.

c. Appurtenant Structures. The canal weir and dike are appurtenant to the dam. The timber weir appears to be in good condition. Settlement of the concrete support piers has occurred and shimming has been done to compensate for the displacement. The east abutment of the timber weir is a concrete wall which is badly deteriorated (photograph 6). The canal dike is tree covered. Seepage was observed at several locations along the toe of this dike but no piping

SECTION 3

VISUAL INSPECTION

3.1 FINDINGS

a. General. The Sebago Lake Dam is located in a broad valley at the outlet of Sebago Lake. The dam appears to be founded on bedrock and glacial till. The various elements of the dam and appurtenances are constructed of stone masonry, timber, and earth embankment. Generally, the dam appears to be in good condition.

b. Dam.

(1) Structural - The Sebago Lake Dam consists of elements constructed of cut stone masonry, stone masonry walls with earth fill, earth embankment, and an appurtenance structure, the weir at the canal, constructed of timber.

The visual inspection of the dam resulted in the following major findings:

(a) The stone masonry faces of the dam are generally in excellent condition. The stones are tight and mortared joints are sound. Some tree and brush growth has occurred on the face, however (photograph 2).

(b) The earth embankment sections are in good condition except for the dikes which extend to the trash rack above the canal gates. Substantial erosion has occurred to these dikes (photograph 7). However, these dikes have no direct bearing on the stability of the main dam. The embankment wing walls of the dam show no signs of settlement, instability, or erosion.

(c) Some seepage is occurring through the masonry sections of the dam just south of the river gates. This seepage has caused erosion of the soil slope downstream of this section.

SECTION 2

ENGINEERING DATA

2.1 DESIGN

The only design data available for the Sebago Lake Dam is in the form drawings, referenced in Appendix B.

2.2 CONSTRUCTION

No engineering data is available regarding construction of the dam.

2.3 OPERATION

The canal gates are operated to maintain sufficient flow in the canal to supply the Eel Weir Power Station with water for its hydroelectric turbines. The river gates are operated to pass flood flows into the Presumpscot River. Both gates are located in buildings which are kept locked. The spillway is an emergency spillway and has no provision for flashboards.

2.4 EVALUATION

a. Availability. Although a complete set of detail design drawings are not available, several drawings, including plans and X-sections were available.

b. Adequacy. Although several drawings are available , they are inadequate for any in depth review of the design and construction, and the assessment is based primarily on visual inspection, past performance history and engineering judgment.

c. Validity. The physical dimensions of the various elements of the dam were measured during the field inspection and were found to agree with the available drawings.

Description - The gates consist of timber closures in steel guides. The canal gates could not be visually inspected due to water leakage. The river gates were inspected from the outlet and were found to be in good condition.

Control Mechanisms - The flow control gates in both the river gate house and the canal gate house are driven by an electro-mechanical combination of motor, belts and gearing. Power supply to the electric motors is 575 volt, 3 phase, 60 Hertz. There is no emergency power supply but both sets of gates can be manually operated. Both sets of gates were operated electrically indicating the system is adequate and functional. The wiring and motor starting equipment are in good condition. The canal gate motor starter has been rewound and is in good condition. The river gate motor is dirty and needs maintenance. All gearing is in good condition. The canal gates can be operated from a remote location and are protected from overtravel by limit switches. A selsyn system indicating gate position was removed several years ago. The river gates must be operated locally.

Top Width - See plan and X-sections in Appendix B-1.

Side Slopes - See plan and X-sections in Appendix B-1.

Zoning - None, see X-sections.

Impervious Core - None.

Cutoff - Stone masonry walls placed on bedrock or glacial till.

Grout Curtain - None.

h. Division and Regulating Tunnel. Not applicable.

i. Spillway.

Type - Broad crested weir constructed of stone masonry. See X-sections, Appendix B-1.

Length - 115 feet.

Crest Elevation - 266.65 (MSL).

Gates - None.

Upstream Channel - About 100 feet upstream of the river gates are the remains of an old coffer dam with a crest elevation at approximately 257.2, 6 feet below normal pond elevation. About 1 1/4 miles upstream of the dam is Whites Bridge.

Downstream Channel - Downstream of the dam there are two channels, the canal and the Presumpscot River channel. The river channel is rocky with some overhanging trees. (See photograph 3). The canal channel is smooth and regular with trees growing on the canal embankments.

j. Regulating Outlets.

Invert - River Gates 248.0'
Canal Gates 250.0'

Size - 5 River Gates @ 6'-5" high by 4'-9" wide
4 Canal Gates @ 8'-10" high by 7' wide

ITEM	STORAGE (acre-feet)
Recreation Pool	223,000
Flood Control	340,000
Design Surcharge	Unknown
Top of Dam	381,500

f. Reservoir Surface. The following are estimated surface areas for Sebago Lake. It was estimated that the surface area of Sebago Lake increases by about 1.3 square miles per foot of increase in height above normal pool elevation.

ITEM	SURFACE AREA (acres)
Top of Dam/Maximum Pool	33,200
Flood Control Pool	32,200
Recreation Pool	29,200

g. Dam

Type - The spillway portion of the dam is a stone masonry gravity section. The other portions of the dam consist of stone masonry walls with earth fill and earth embankment.

Length - The length between abutments is about 440 feet. Wing walls (earth embankments) extend outward from the abutments about 30 feet south and several hundred feet to the north.

Height - The top of the dam is about 25 feet above the level of the streambed. Top of dam elevation is approximately 268.4.

c. Elevation. The following is a table of pertinent elevations at the Sebago Lake Dam site:

ITEM	ELEVATION ABOVE MSL
Top of Dam	268.4
Maximum Pool-Design Surcharge	Unknown
Full Flood Control Pool/ Legal High Water	267.15
Recreation/Normal Pool	263.5 ±
Spillway Crest	266.65
Diversion Tunnel Invert	Not Applicable
Streambed at Centerline of Dam	246.2
Maximum Tailwater	Unknown
Test Flood Elevation (MPF)	273.9

d. Reservoir. The lengths of the maximum pool (Elevation 268.4 feet), the recreational pool (Elevation 263.5 feet), and the flood control pool (Elevation 267.15 feet) were estimated from USGS maps. The lengths are shown below:

LOCATION	LENGTH (miles)
Maximum Pool	13.2
Recreational Pool	13.1
Flood Control Pool	13.1

e. Storage. Storage volumes at Sebago Lake were estimated by extrapolating the normal storage as listed in the current Inventory of Dams in the United States.

i. Normal Operating Procedure. The canal gates are operated to maintain sufficient flow in the canal to supply the Eel Weir Power Station with water for its hydroelectric turbines. The river gates are operated to pass flood flows into the Presumpscot River. Both gates are located in buildings which are kept locked. The spillway is an emergency spillway and has no provision for flashboards.

1.3 PERTINENT DATA

a. Drainage Areas. The drainage area above Sebago Lake Dam is approximately 436 square miles, of which Sebago Lake's surface area is approximately 45.6 square miles. The watershed may be characterized as flat and coastal.

b. Discharge at Damsite. There are five river gates which are 4 feet 9 inches in width by 6 feet in height. The upstream invert elevation (MSL) is about 254.0 feet, and the downstream invert elevation (MSL) is about 248.0 feet. There are four canal gates which are 7 feet in width by 8 feet 10 inches in height. The upstream and downstream invert elevations are both 249.7 feet. The following are pertinent discharges:

(1) Maximum known flood (1902) at damsite was about 7000 cfs.

(2) Ungated spillway capacity at top of dam is about 970 cfs at elevation 268.4.

(3) Ungated spillway capacity (total spillway capacity) at test flood (MPF) elevation is about 8440 cfs at elevation 273.9.

(4) Gated spillway capacity is not applicable.

(5) Total project discharge at test flood (MPF) elevation is about 27,300 cfs at elevation 273.9.

b. Description of Dam and Appurtances. The Sebago Lake Dam is a stone masonry dam. Portions of the dam are entirely masonry while other sections are masonry walls with soil fill. The wings of the dam are earth embankment. The masonry portion of the dam is about 440 feet in length. The south embankment is about 30 feet long and the north embankment is at least 500 feet long. The dam is about 25 feet high.

An appurtenant structure at the Sebago Lake Dam is the timber weir at the Eel Weir Canal and the canal dike.

c. Size Classification. Based on storage capacity the Sebago Lake Dam is classified as a large dam.

d. Hazard Classification. In the event of failure of the Sebago Lake Dam, there would be extensive damage and possible loss of life downstream as far as and through the city of Westbrook, about 15 miles away. Thus the Sebago Lake Dam is classified as having a high hazard potential.

e. Ownership. S. D. Warren Company
89 Cumberland Street
Westbrook, Maine 04092

f. Operator. S. D. Warren Company
Tel: 1-207-856-6311

g. Purpose of Dam. The Sebago Lake Dam is used for control of water storage in Sebago Lake for flood control, recreation, and hydroelectric power generation at the Eel Weir Power Station downstream.

h. Design and Construction History. A compilation of available design data is included in Appendix B-1. A dam was constructed at the site prior to 1830 as a part of the Cumberland and Oxford Canal. Prior to 1878 a second dam was built at the site and in 1878 and 1879 the present dam structure was built for the Presumpscot Water Power Co. In 1902 the crest of the spillway was lost in a flood, and in 1903 major repairs to the existing dam were made and new construction was undertaken on the southerly portion of the dam for installation of control gates for the Eel Weir Falls Power plant. Substantial repair was done in 1911. There is no record of any more recent major construction.

PHASE I INSPECTION REPORT

SEBAGO LAKE DAM

SECTION 1

PROJECT INFORMATION

1.1 GENERAL

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Edward C. Jordan Co., Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Maine. Authorization and notice to proceed were issued to Edward C. Jordan Co., Inc. under a letter of June 20, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0349 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) To encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 DESCRIPTION OF PROJECT

a. Location. The Sebago Lake Dam is located at the head of the Presumpscot River (outlet of Sebago Lake) in the towns of Standish and Windham, Maine. N 43°-50', W 70°-27'-30'

between the Sebago Lake Dam and the city of Westbrook. The 500 year flood plain is about 1200 feet wide at Bridge Street, at its widest point in Westbrook. Since the breaching of Sebago Lake Dam would probably cause extensive damage and possible loss of many lives downstream as far as through the city of Westbrook, the dam is classified as having a high hazard potential.

Having been classified as a high hazard potential dam, the Sebago Lake Dam was analyzed for passing the maximum probable flood. The maximum probable flood (MPF) has been calculated to be 91,500 cfs, according to the COE "Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Dam Safety Investigations." Consideration of the effect of surcharge storage was taken into account by applying the Corps of Engineers' HEC-1 computer program model for routing hydrographs. Surcharge storage reduces the MPF to 27,300 cfs. The total capacity at the dam is approximately 6,720 cfs, which is about 25 percent of the adjusted MPF.

SECTION 6

STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Based on the visual observations, the dam appears to be in good structural condition. As outlined in Section 7, some maintenance of the dam and appurtenant structure is necessary.

6.2 DESIGN AND CONSTRUCTION DATA

The design and construction data found to be available is in the form of drawings which are referenced in Appendix B-1. Measurements and observations made during field inspection were used to confirm the data available in the drawings.

a. Operating Records. Records of the performance of the dam reveal that a failure of the spillway occurred in 1902 and that a different section configuration was reconstructed. The reconstructed dam passed a major flood in 1936 without distress.

b. Post Construction Changes. No distortion of the structure is apparent. The masonry appears tight and the only change noted is tree and brush growth in the masonry. Some change has occurred in the form of erosion along the dikes which make up a portion of two head works trash screen above the canal gates. Major design and construction changes which have been made are noted in Appendix B-6.

c. Seismic Stability. The dam is located in seismic Zone No. 2 and in accordance with recommended Phase I guidelines, does not warrant seismic analysis.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Condition. The visual inspection and compilation of available engineering data indicate that the Sebago Lake Dam is in good condition. The control outlets and spillway will pass approximately a 200-year flood without overtopping of the dam. The stability of the structure is assessed to be good under this condition. The maximum probable flood (MPF) peak flow at the Sebago Lake Dam has been calculated to be approximately 91,500 cfs. Due to the effect of surcharge storage, the reduced peak flow is approximately 27,300 cfs. The outlet and spillway capacity of the Sebago Lake Dam is about 25 percent of this reduced MPF. Overtopping of the dam would likely result in erosion and progressive breaching of the embankment which makes up the north wing wall of the dam.

b. Adequacy of Information. The information available is such that the assessment of the condition of the dam must be based primarily on the visual inspection findings, engineering judgment, and performance history of the dam even though several drawings of the dam are available.

c. Urgency. Although the dam is assessed to be in good condition, there are recommendations and remedial measures that should be implemented within two years after receipt of this report by the owner.

d. Need for Additional Investigation. Additional investigation is not considered necessary for Phase I assessment.

7.2 RECOMMENDATIONS

The spillway discharge capacity is considered inadequate. Further hydrologic studies by qualified engineers are necessary to determine what alternative measures may be necessary to significantly increase the discharge capabilities at the dam.

7.3 REMEDIAL MEASURES

a. Alternatives. Not applicable.

b. Operating and Maintenance Procedures. The program of regular inspection and maintenance of the dam should be continued and a record of this program should be kept. The following specific maintenance and operating procedures should also be implemented:

1. Trees and brush should be cut from all masonry faces of the dam.

2. A reinforced concrete wall should be placed in the old canal lock to replace the old timber gate which is badly deteriorated.

3. The timber remains of the sluiceway support in the masonry face of the spillway should be removed and replaced by stone or concrete.

4. The springs located downstream of the north wing wall should be covered by a graded soil filter to prevent migration of fines from beneath the dam structures.

5. The seepage coming from the masonry south of the river gates should be monitored particularly with respect to erosion which is occurring on the slope downstream of the seepage.

6. The eroded areas of the dike making up a portion of the canal gates trash screen should be refilled and protected from further erosion.

7. The river gate motor is dirty and needs maintenance.

8. Although not directly related to the overall safety of the main structure of the dam, consideration should be given to the maintenance of the timber deck, concrete support piers, and badly deteriorated east abutment of the spillway at the Eel Weir Canal.

9. A program of around the clock surveillance should be provided for periods of anticipated high run-off.

10. A plan for a formal warning system which could be used in the event of an emergency should be developed.

11. Periodic inspections (at 5-year intervals) should be made by qualified engineers.

APPENDIX A

FIELD INSPECTION NOTES

Inspection Date: July 27, 1978

Inspection Team:

Name	Discipline
Brian Bisson	Hydrology
Stephen Cole	Geotechnical
Ernest Jurick	Photography
John Kimble	Survey
Henry Oatley	Structural

1. CONCRETE AND STONE MASONRY STRUCTURE

a. Concrete Surfaces - The concrete portions of the structure are generally good except for the abutment walls and piers supporting the timber Eel Weir Canal spillway. The walls are badly spalled and cracked and the piers are badly cracked (photograph 6).

Stone Masonry - The cut stone masonry portion of the dam is mortar laid and is in excellent condition. The rubble stone masonry portions including the dry laid stone north wing wall are in good condition. The masonry was found to be tight in all areas. There are timber sills for a sluiceway since removed located in the downstream face of the spillway which are deteriorating, (see profile). Some tree and brush growth has occurred in the masonry (photograph 2).

b. Structural Cracking - No cracking of the elements of the main dam were found during the inspection, however, the abutment walls and support piers of the timber Eel Weir Canal spillway are badly cracked. The cracking appears to be due to deterioration of the concrete and reflection of cold joints and not due to over stressing. See photograph 6.

c. Movement - No horizontal or vertical movement of the main dam was noted during inspection. One of the support piers for the timber Eel Weir spillway has settled at least 8 inches and a shim has been placed on its top. See photograph 1.

d. Junctions - The major junctions of the main dam show no signs of distress. The junctions of the Eel Weir Canal spillway to the main dam and to the abutment wall at the canal dike are leaking substantially although there is no sign of movement at these locations.

e. Drains - There are no formal drainage systems shown on the available plans and none were observed.

f. Water Passages - The main river gate outlets are constructed of cut stone masonry and are in excellent condition (photograph 2).

g. Seepage or Leakage - Some seepage was observed coming through the face of the main river portion of the dam through the masonry. A substantial amount of seepage was also observed coming through the masonry just south of the main river gate house.

h. Monolith Joints - Not applicable.

i. Foundation - No undermining or distress of the foundation of the main dam was noted, however, seepage has apparently caused some undermining at two points along the north wing wall, see Plan.

j. Abutments - The south abutment of the dam is apparently on a glacial till foundation and shows no sign of distress. The north abutment (north end of the spillway) appears to be founded on bedrock and shows no sign of distress.

2. EMBANKMENT STRUCTURES

Both the south and north wings of the dam are essentially embankment structures.

a. Settlement - Observation of the embankment portions of the dam found no signs of settlement.

b. Slope Stability - The embankment south of the masonry portion of the dam shows no signs of slope instability; the embankment slopes are quite flat. North of the spillway, the north wing wall of the dam consists of an embankment retained by a stone masonry wall. The wall appears true to line and grade. North of the retained section the embankment section has 2 on 1 slopes and the slopes appear stable.

c. Seepage - Seepage was observed to be coming from the top of the retaining wall along the north wing of the dam. Concentrated flow was observed at two locations along the wall (see Plan). An iron spring with no flow was also observed below the top of the north embankment (see Plan). Many points of seepage were found along the top of the canal dike.

d. Drainage Systems - No drainage systems are known to exist in the dam. Visual inspection revealed none.

e. Slope Protection - The embankment materials in the main portion of the dam are protected in stone masonry walls. The south and north embankment wings have no slope protection, however, serious erosion was not in evidence. Serious erosion has occurred along the embankment portions of the canal gates trash rack upstream of the dam (photograph 7).

3. SPILLWAY STRUCTURES

The spillway consists of a broad crested granite weir. See photograph 8.

a. Control Gates - Not applicable.

b. Unlined Saddle Spillways - Portions of the north wing embankment form an unlined saddle spillway since low areas could be overtopped. No erosion was observed however.

c. Approach and Outlet Channel - Both the approach and outlet channels are reasonably clear and unobstructed (photographs 2 and 8).

d. Stilling Basin - The stilling basin consists of the bedrock in the downstream channel.

4. OUTLET WORKS

The outlet works at the Sebago Lake Dam consists of four gates which outlet water to the Eel Weir Canal and five gates which outlet to the Presumpscot River.

a. Inlet structure - For the canal gates, this consists of granite block retaining walls which are in good condition. Above the inlet is a trash rack, see photograph 7. The inlet structure for the river gates is also granite stone masonry in good condition (photograph 5). A trash rack exists above these gates.

b. Operation and Emergency Control Gates - The flow control gates in both the river gate house, (see photograph 9), and the canal gate house, (see photograph 10), are driven by an electromechanical combination of motor, belts and gearing.

Power supply to the electric motors is 575 volt, 3 phase, 60 Hertz. There is no emergency power supply but both sets of gates can be manually operated. Both sets of gates were operated electrically indicating the system is adequate and functional. The wiring and motor starting equipment are in good condition. The canal gate motor starter has been rewound and is in good condition. The river gate motor is dirty and needs maintenance. All gearing is in good condition. The canal gates can be operated from a remote location and are protected from overtravel by limit switches. A selsyn system indicating gate position was removed several years ago. The river gates must be operated locally.

c. Conduits, Sluices, Water Passages - The canal gates sluice could not be visually inspected due to water level. The river gate sluices were found to consist of granite stone masonry and are in good condition.

d. Stilling Basin - The stilling pool below the canal gates could not be visually observed due to the depth of water. The stilling basin for the river gate outlets is the bedrock channel of the river.

e. Approach Channel - In the area of the outlet works for both the river gates and the canal gates there appears to be no buildup of silt. Approximately 100 feet upstream of the canal gates is a trash rack which is about 90 feet long. Approximately 100 feet upstream of the river gates there is an abandoned coffer dam with a crest elevation at approximately 257.2 feet, 10 feet below normal pond elevation. Since the coffer dam is breached on its northerly end, it would not appear to be a restriction on the river gates. On the upstream side of the river gates is a trash rack which is unobstructed. About 1 1/4 miles upstream of the dam is Whites Bridge which has an opening width of about 160 feet.

f. Drawdown Facilities - The canal gates are used to maintain sufficient flow to the Eel Weir Canal hydroelectric facility which is about 1 mile downstream of the Sebago Lake Dam. The river gates are used to pass flood flows.

5. SAFETY AND PERFORMANCE INSTRUMENTATION - None.

6. RESERVOIR

a. Shore Line - No major active or inactive landslide areas on Sebago Lake were observed.

b. Sedimentation - The watershed has remained essentially rural in nature over the past years. There are no major new developments or new sources of sediment loads on the lake. The many lakes and ponds that dot the Sebago Lake watershed would tend to reduce the sediment load that reaches Sebago Lake.

c. Potential Upstream Hazard Areas - Sebago Lake has many cottages and year round residences surrounding it, many of which would be affected by maximum probable flood elevations, but not by maximum water storage pool elevation.

d. Watershed Runoff Potential - The drainage basin has remained essentially rural with very few changes in development. The many lakes and ponds that dot the Sebago Lake watershed tend to reduce flood peaks that reach Sebago Lake.

7. DOWNSTREAM CHANNEL

The canal channel downstream of the dam is regular in shape with overhanging trees on the embankments. The river channel is rocky with overhanging trees on the embankments (photographs 3 and 4).

8. OPERATION AND MAINTENANCE FEATURES

a. Reservoir Regulation Plan - None.

b. Maintenance - Maintenance is done at the dam on an as-needed basis. In general, the dam is maintained in good condition. Frequent inspections are made by S. D. Warren Co. personnel to correct vandalism and to do necessary repairs.

APPENDIX B

ENGINEERING DATA

iis appendix lists the engineering data collected either
om project records and other sources of data developed as
result of the visual inspection. The contents of this
ppendix are listed below.

Appendix	Description
B-1	General Project Data
B-2	Foundation Data & Geological Features
B-3	Properties of Embankments and Foundation Materials
B-4	Concrete Properties
B-5	Electrical and Mechanical Equipment
B-6	Construction History
B-7	Operation Record
B-8	Inspection History

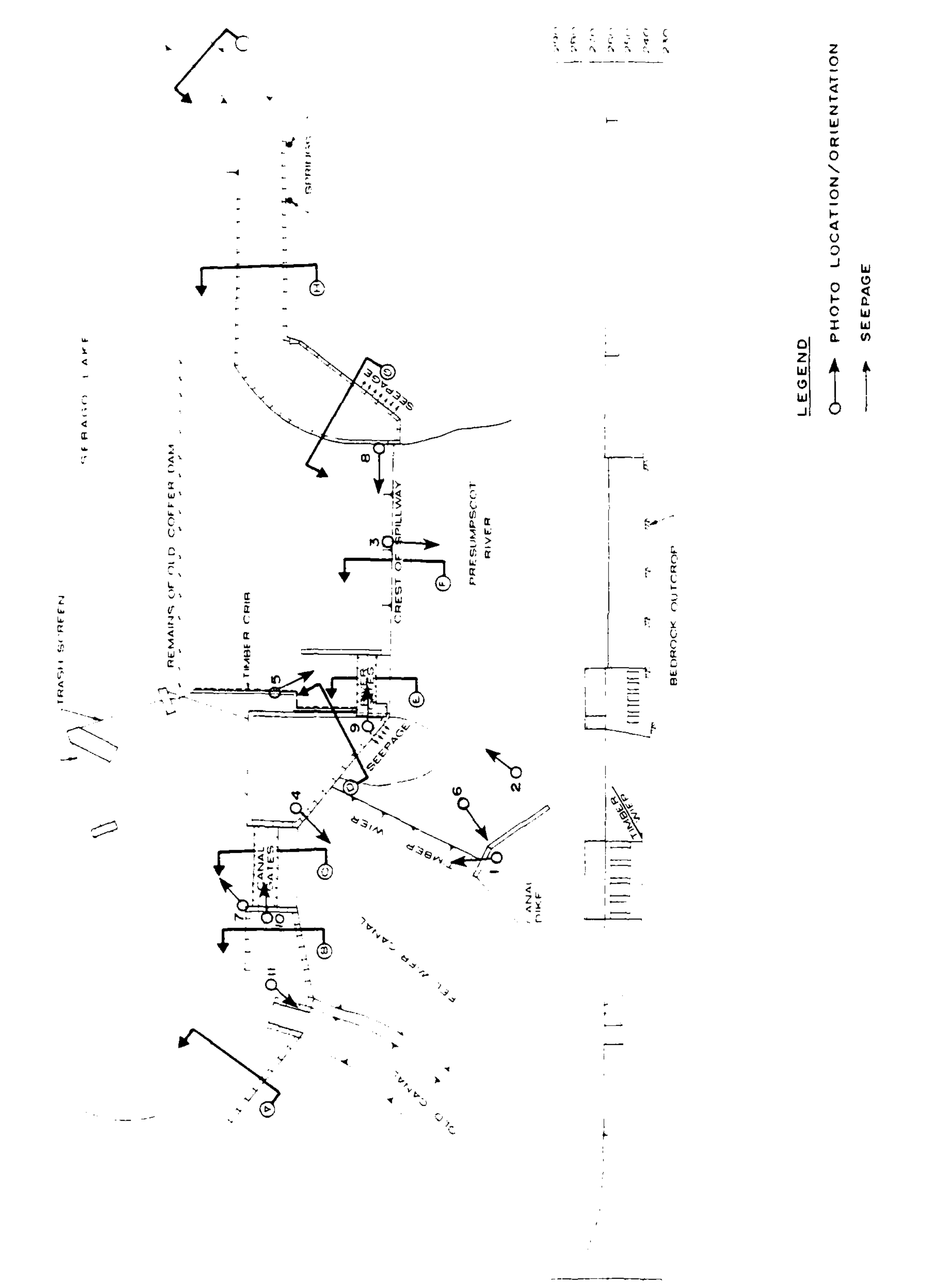
APPENDIX B-1

GENERAL PROJECT DATA

e following drawings of the Sebago Lake Dam are located
the S. D. Warren Company:

Drawing No.	Title
F-18	Plan of Dam at Wescott's Falls
F-3	Plan of Dam built by Presumpscot Water Power Co. at Outlet of Sebago Lake 1878-79
C1-3	Hoisting Gear for Headgates at Lake Sebago
5898	Eel Weir Falls Power Plant
5644	Proposed Dam at Sebago Lake
F-467	Sebago Lake Basin Reservoir Dam and Appurtenances
F-609	Design for Reconstruction of Reservoir Dam at Lake Sebago
C-18389	Old Sebago Dam Structure

levations noted on these drawings are referenced to
. D. Warren's datum which is 3.47 feet above USGS mean
ea level datum. A plan, a profile and several X-sections
ave been developed based on data obtained during the visual
nspection. These drawings, attached to this section, are
eference to USGS mean sea level datum.



HORIZONTAL & VERTICAL

0 30 60 FEET

B-1.2

EDWARD C. JORDAN CO., INC. PORTLAND, MAINE

U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

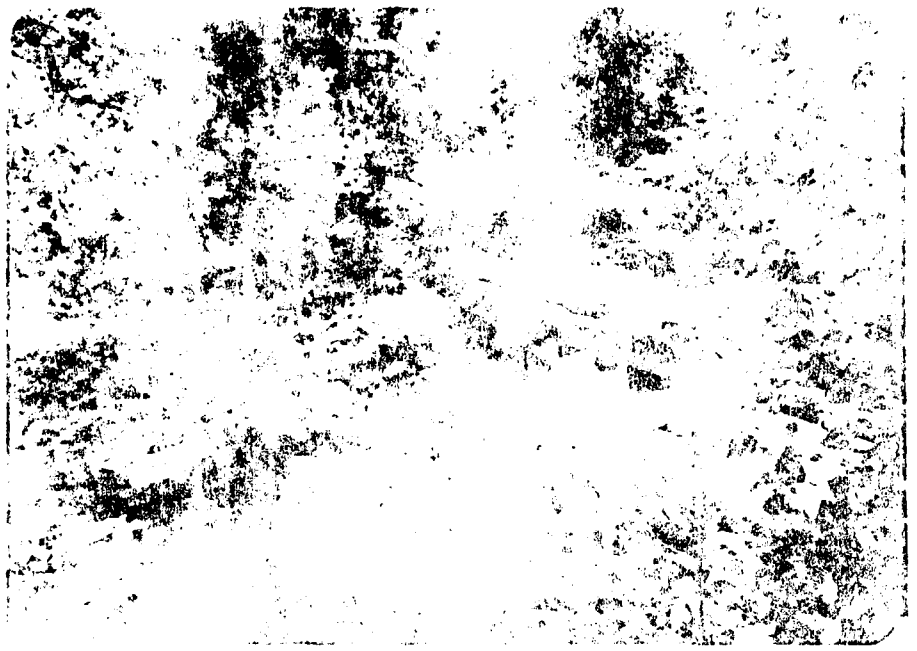
SEBAGO LAKE DAM

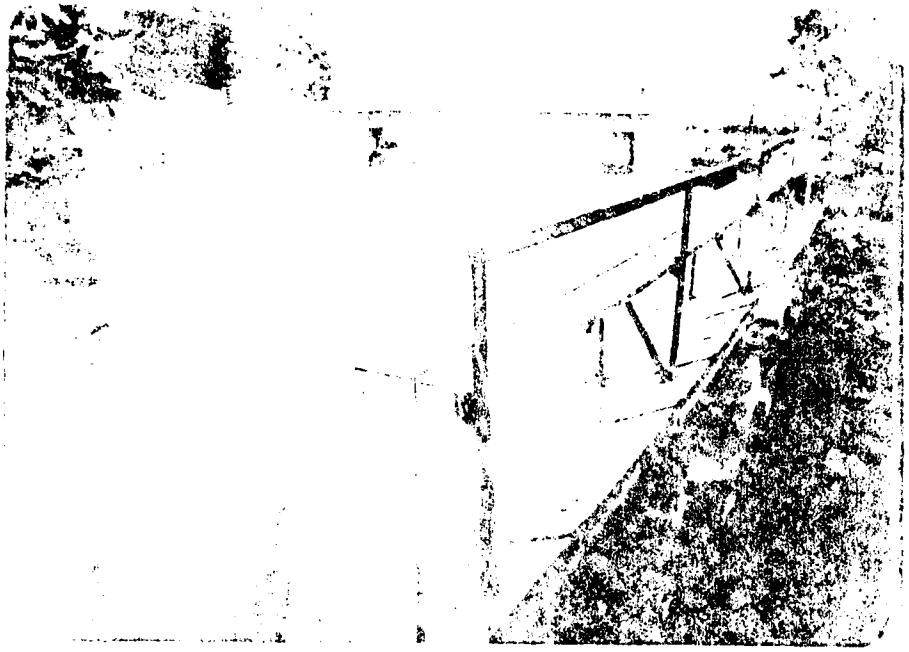
PROFILES

PRESUMPSCOT RIVER MAINE

SCALE: AS SHOWN

DATE: SEPT. 1978

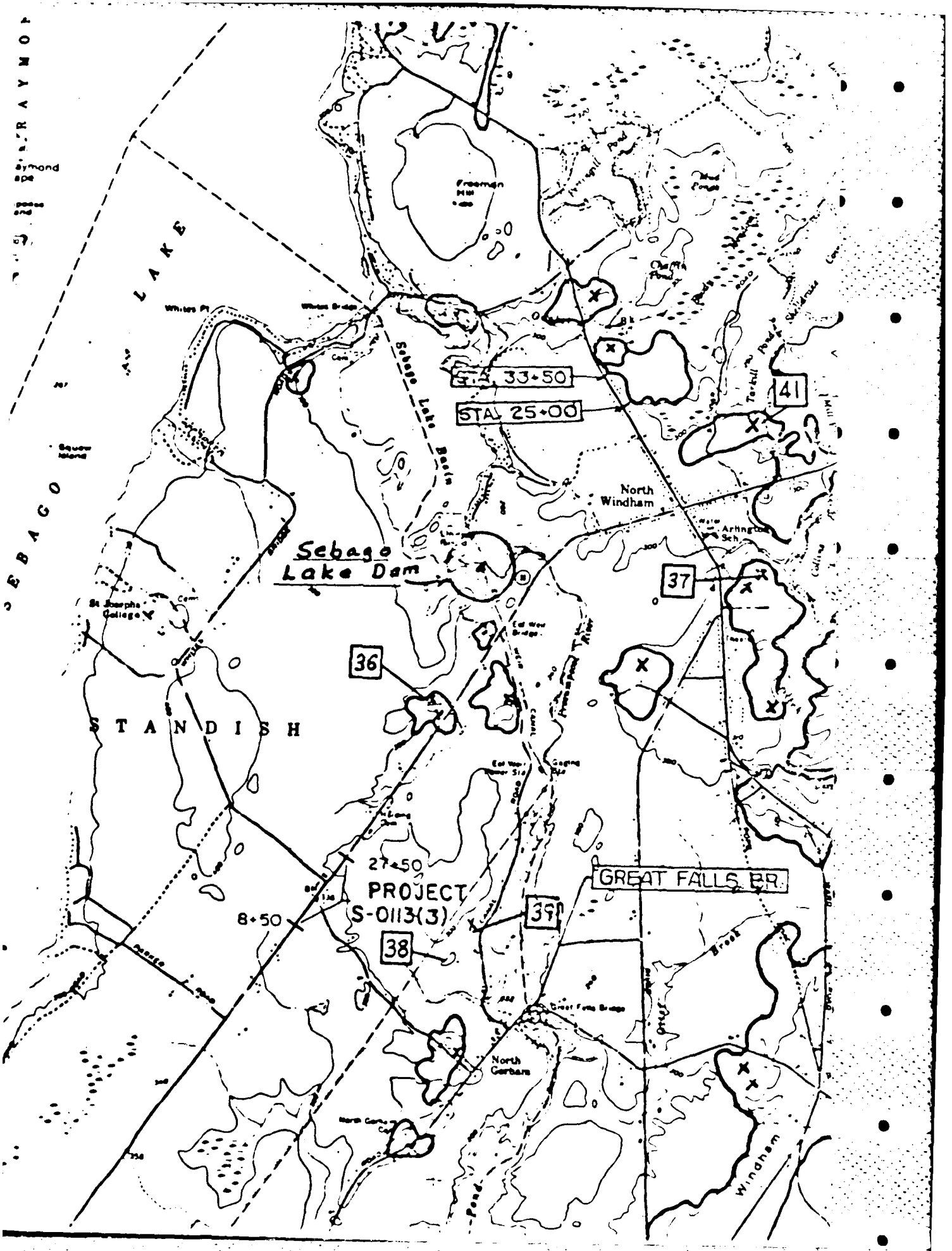




APPENDIX C

PHOTOGRAPHS

he following are photographs referenced in this report.
ee sheet B-1.2 for photograph locations and orientations.


SEBAGO LAKE
Sebago Lake Basin
STA. 33+50
STA. 25+00
41
North Windham
Sebago Lake Dam
37
36
STANDISH
27+50
PROJECT
S-0113(3)
8+50
38
39
GREAT FALLS BR.
North Gorham
Windham

DAM INSPECTION #7 2/2/78

BEDROCK REPORT

Sebago Lake Dam

Windham COUNTY: Cumberland

: Presumpscot

OF DAM: Gravity

SE: Water supply originally; now used to maintain lake level

T(FT.): 25

ITY(ACRE FT.): 249,700

LYING BEDROCK: Granite and/or quartz monzonite

TION: This is a large complex dam at the southern terminus of Sebago Lake Basin. Water flows into both the Presumpscot River and Eel Wier Canal. There is also an overflow dam whereby water can be drained off from Eel Wier Canal into the river proper. The dam surface is composed of large granite blocks. It is unknown whether or not the dam was placed on bedrock. No bedrock outcrops in the near vicinity and it is assumed to be quite deep. The contact between this granite and the Eliot Formation, which is composed of metamorphosed shale, siltstone and minor sandstone, occurs probably about 2000 feet downstream from the dam. This is not known to be a fault zone, but rather a contact between the intruding igneous body and the older metamorphic rocks.

This area is in seismic zone 2 which may be assumed to present no hazard due to earthquakes. Further, the constriction at Whites Bridge will tend to control the influx of a maximum amount of available water from the main body of the lake, should a catastrophe occur. The earthquake of January 23, 1910, had a calculated epicenter near Fosters Corner in Windham and was felt over 390 sq. km. (150 sq. mi.). It's intensity was reported as V M.M. but no known damage occurred to the dam, which had been constructed four years earlier. The quake of October 1925 had its calculated epicenter near Limington and had an intensity of VI M.M.. It was felt over an area of 39000 sq. km. (15,000 sq.mi.). Again, there was no known damage at the dam site.

INSPECTION REPORT
for
SEBAGO LAKE DAM

On February 2, 1978, Everett Barnard, Assistant Bridge Maintenance Engineer; Philip J. Libby, Structural Project Design Engineer; Guy Baker, Assistant Soils Engineer; and Charles Norberg, Geologist met John MacGregor, from S. D. Warren, at the mill in Westbrook, who took them to the site of Sebago Lake Dam. The Dam is used to control the water level in Sebago Lake, the flow thru Eel Wier Canal, and the Presumpscot River. John MacGregor told us that by legislative action S. D. Warren is required to maintain at least a certain flow as long as the water level in Sebago Lake is above a designated elevation. This flow is divided between the Canal and the River. Also there is a maximum allowed elevation for the Lake.

There are two separate sets of gates built into the Dam. One set controls the flow into Eel Wier Canal and the other into Presumpscot River. The set that flows into the Canal are operated by electricity and are those used to refine the flow from the Lake. The ones that discharge into the River are manually operated and are used to control during high level of anticipated flow. Flow in the Canal is further controlled by a spillway into the River just below the Dam.

On this date the water level was reportedly high for the season and considerable water was being discharged into the River though the Lake level was below spillway elevation. The spillway elevation is said to be 3'± above the mean elevation shown on U.S. Geological Survey Map. The flow through the Canal gate maintained a flow that was 1'± below the spillway from the Canal into the River. There was considerable flow through the gates into the River. The gate settings were 50% capacity on both the Canal and the River gates, according to Mr MacGregor.

There was flow enough to have free water 200'± upstream from the Dam.

The westerly end of the dam empties into the Canal and is close to to apparent original ground. The easterly end appears to be a dike built many years ago as tree growth on the dike is the same as surrounding terrain.

About a mile north of the Dam there is a restriction known as White Bridge which spans a 75' channel with approximately 10' of water. There is open water in this area also indicating a considerable flow of water at this point.

There are a number of lakes in the watershed around Sebago Lake with relatively small drainage area. This condition safeguards against large increases of water heads being applied to Sebago Lake Dam. The two drainage channels from the Dam decreases the threat on either one considered singly. The restriction at "White Bridge" slows and reduces the flow in event of sudden collapse of the Dam. These considerations, with a structure that appears well maintained and well keyed into the surrounding environments, indicate a minimum danger to the flood plain area that is relatively sparsely settled downstream from the Dam.

Reported by _____

APPENDIX B-8

INSPECTION HISTORY

An inspection of the Sebago Lake Dam was made by Maine Department of Transportation personnel on February 2, 1978. A copy of their report is attached.

APPENDIX B-7

OPERATION RECORD

The flood of record at Sebago Lake occurred in April, 1902. It is unknown if issuance of alert or evacuation warnings took place. The following is a table of flood data at Sebago Lake Dam:

Flood Date	Outflow cfs	Water Surface Elevation
1902	7000	267.7
1922	3210	267.5
1928	2370	267.3
1936	3790	268.1
1952	3620	267.1

There are no known records of performance observations made by instrumentation. Also, there are no known operational deficiencies that pose a threat to the safety of the dam.

A failure of the spillway section of the dam occurred in 1902. Plans showing the failure and corrective measures are Drawings F609 and 5644, which are located at the S. D. Warren Company.

APPENDIX B-5

ELECTRICAL AND MECHANICAL EQUIPMENT

Except for Drawings 5898 and C1-3, there is no information available concerning electrical and mechanical equipment at the Sebago Lake Dam.

APPENDIX B-6

CONSTRUCTION HISTORY

A dam was constructed at the site prior to 1830 as a part of the Cumberland and Oxford Canal. Prior to 1878 a second dam was built at the site and in 1878 and 1879 the present dam structure was built for the Presumpscot Water Power Co. In 1902 the crest of the spillway was lost in a flood, and in 1903 major repairs to the existing dam were made and new construction was undertaken on the westerly portion of the dam for installation of control gates for the Eel Weir Falls Power Plant. Further repairs were made to the spillway in 1911. There is no record of any more recent major construction.

APPENDIX B-2

FOUNDATION DATA AND GEOLOGICAL FEATURES

Based on the available drawings, (F-609, 5644, and 5898) it appears that the spillway and main gated outlet portions of the dam are founded on bedrock, and that the portion of the dam west of the gated outlet is founded on "solid pin gravel," likely glacial till.

APPENDIX B-3

PROPERTIES OF EMBANKMENT AND FOUNDATION MATERIALS

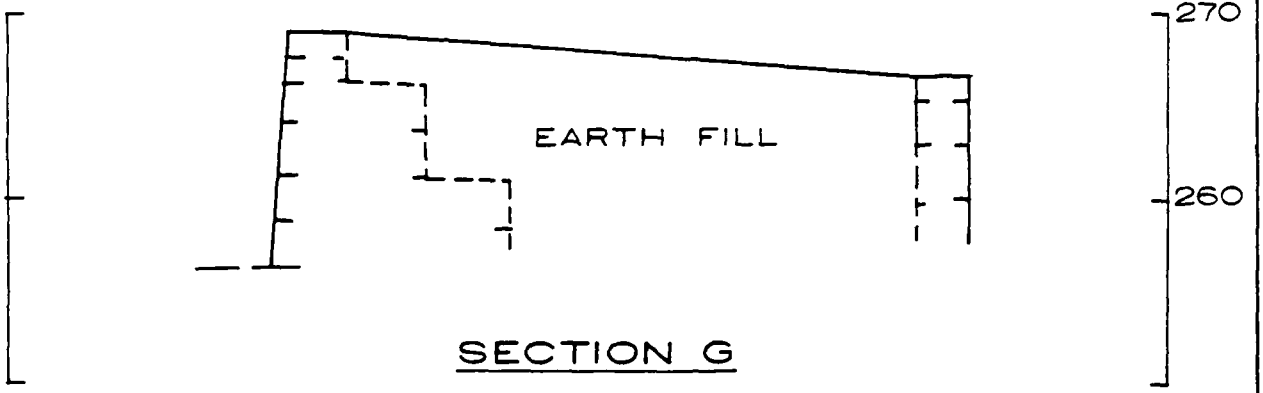
Based on available drawings (F-609, 5644, and 5898) it appears that the spillway and gated river outlet are founded on bedrock. The westerly portion of the dam is apparently founded on "solid pin gravel," likely glacial till.

Based on Drawing 5898, fill within the masonry portions of the dam consists of gravel.

APPENDIX B-4

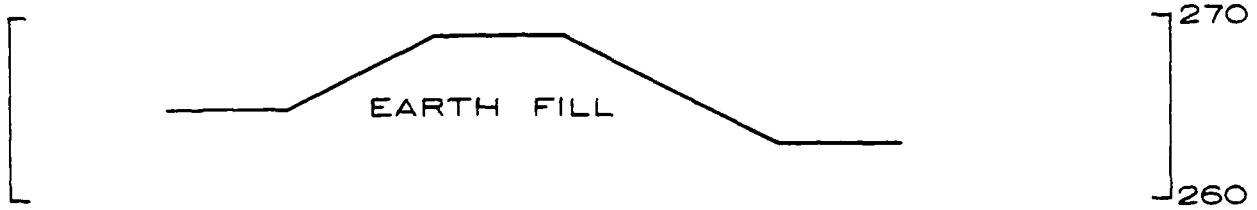
CONCRETE PROPERTIES

No records are available regarding the properties of the concrete used in the Sebago Lake Dam, however, reference is made to boulder concrete on Drawing 5898.



SECTION G

SECTION H



SECTION I

EDWARD C. JORDAN CO., INC. PORTLAND, MAINE

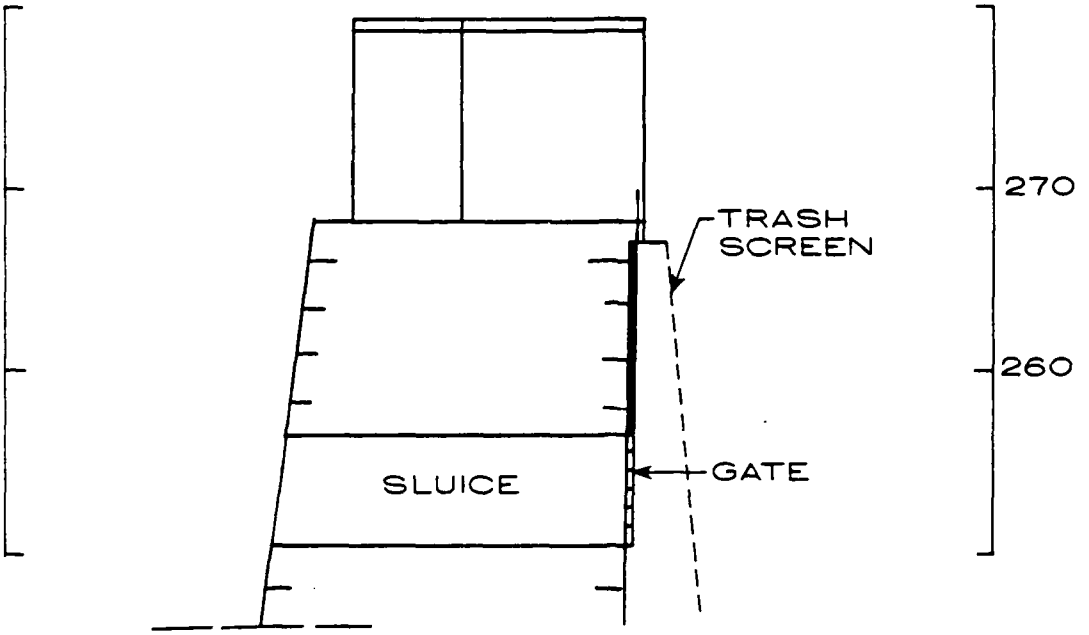
U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

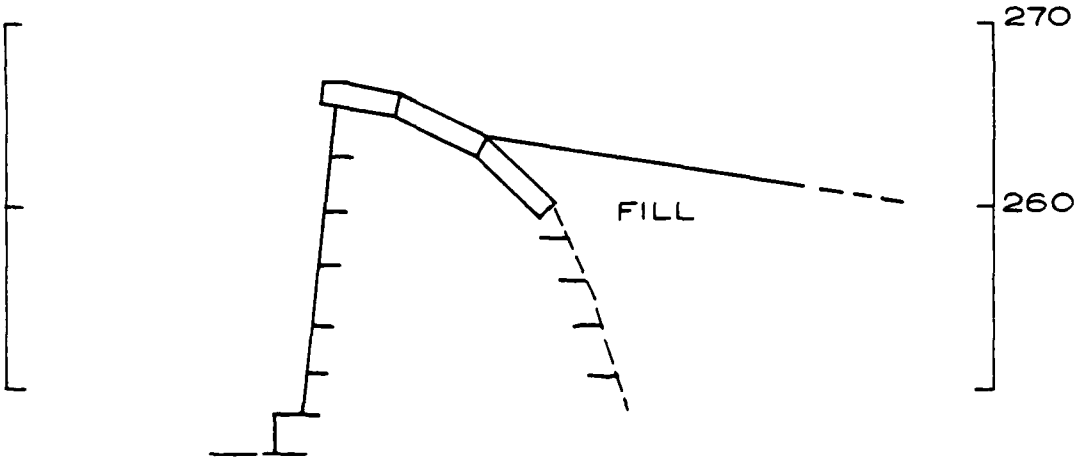
SEBAGO LAKE DAM
X - SECTIONS
PRESUMPSCOT RIVER MAINE

SCALE

DATE SEPT 1978



SECTION E



SECTION F

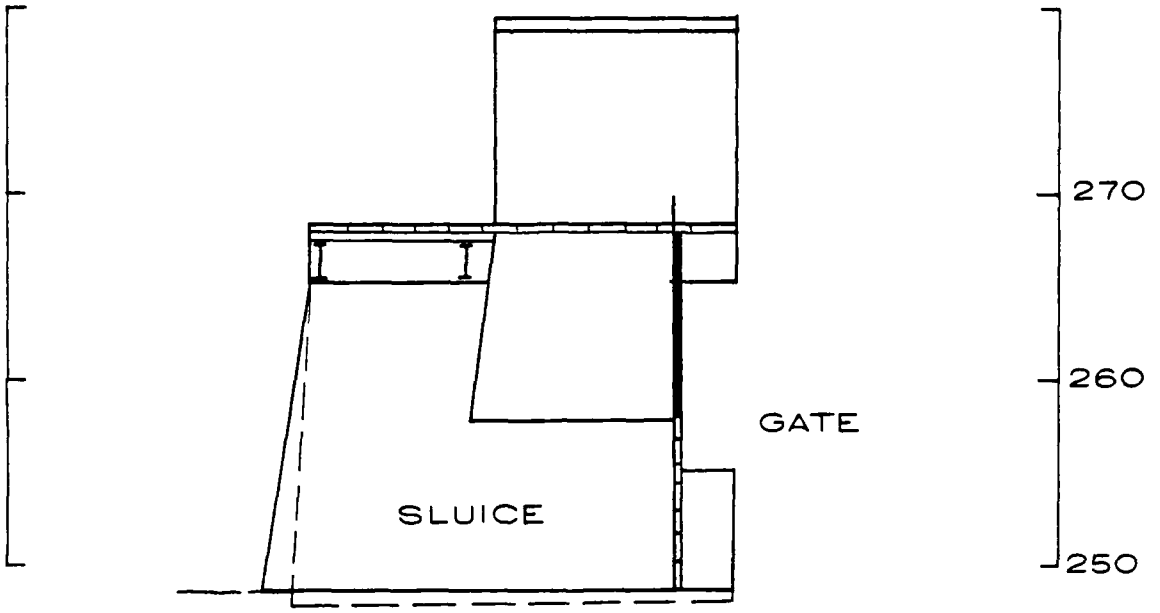
EDWARD C JORDAN CO INC
PORTLAND MAINE

U.S. ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM MASS

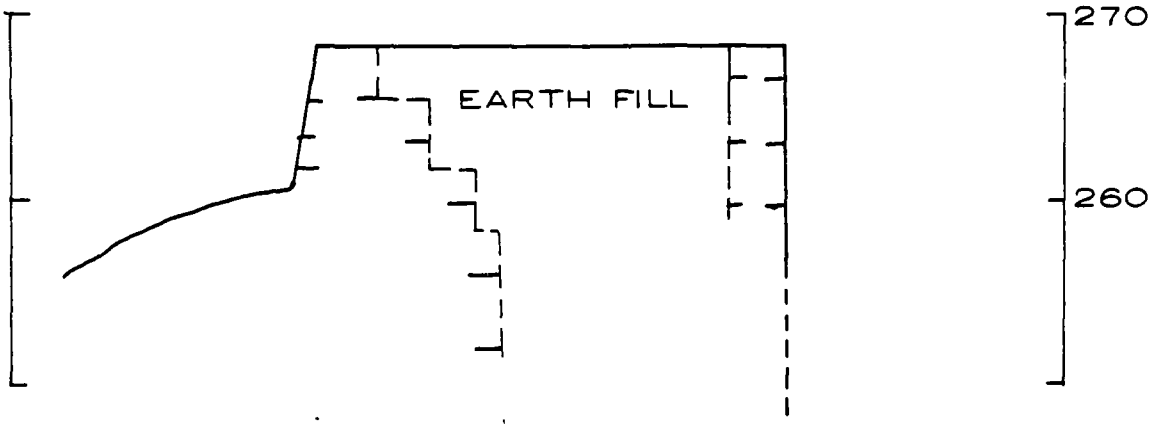
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

SEBAGO LAKE DAM
X-SECTIONS
PRESUMPSCOT RIVER MAINE

SCALE
DATE SEPT. 1978



SECTION C



SECTION D

EDWARD C. JORDAN CO., INC. PORTLAND, MAINE

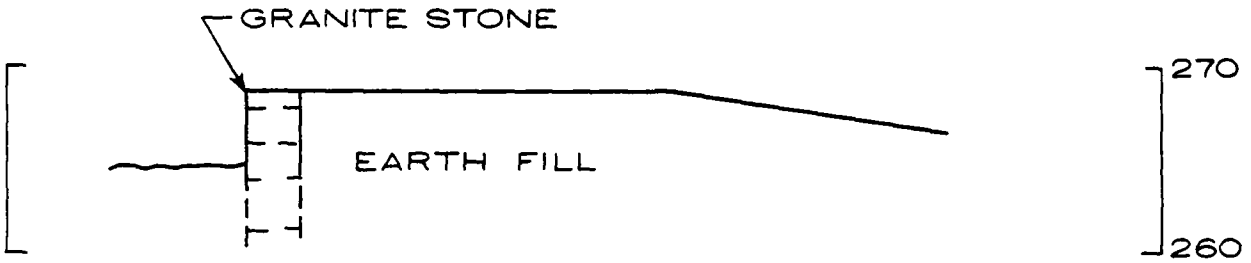
U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

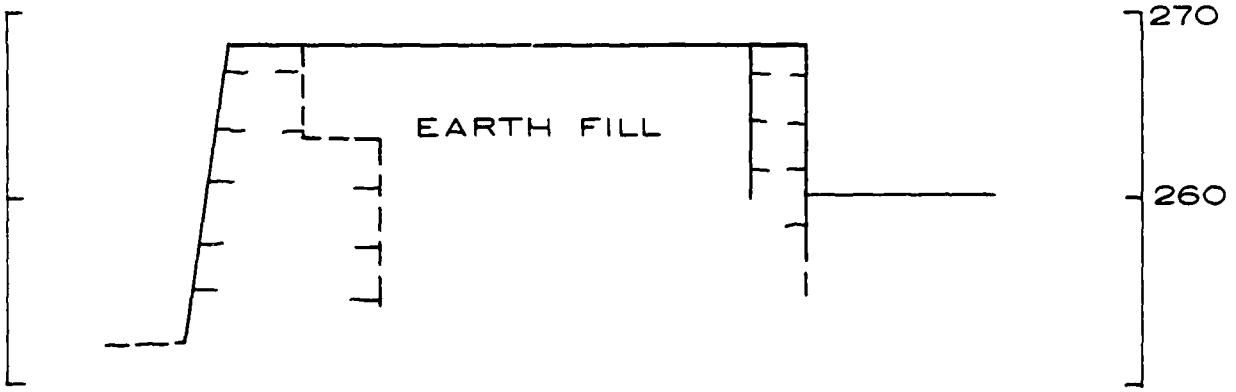
SEBAGO LAKE DAM
X - SECTIONS

PRESUMPSCOT RIVER MAINE

DATE SEPT 1975



SECTION A



SECTION B

EDWARD C. JORDAN CO. INC. PORTLAND, MAINE

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

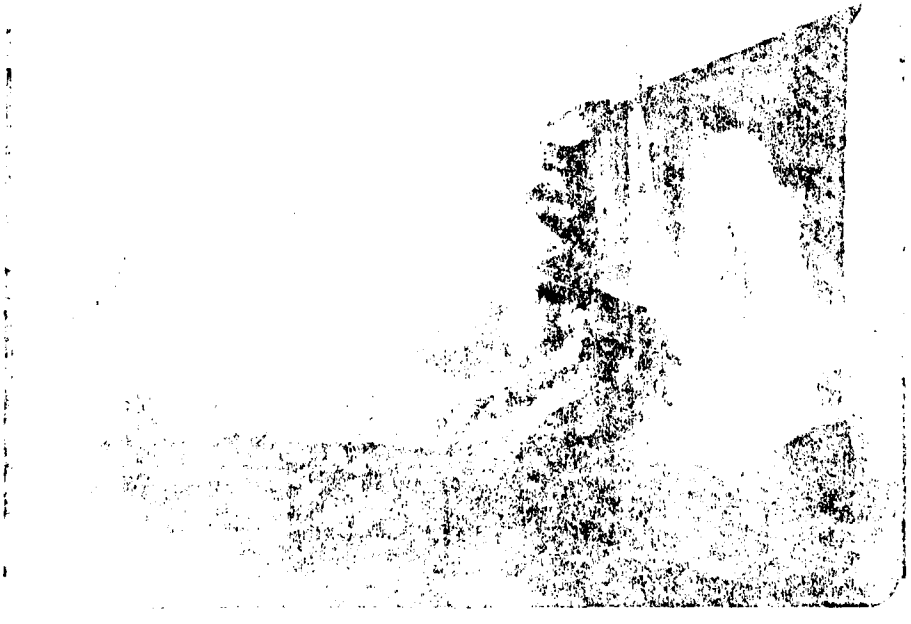
SEBAGO LAKE DAM
X-SECTIONS

PRESUMPSCOT RIVER MAINE

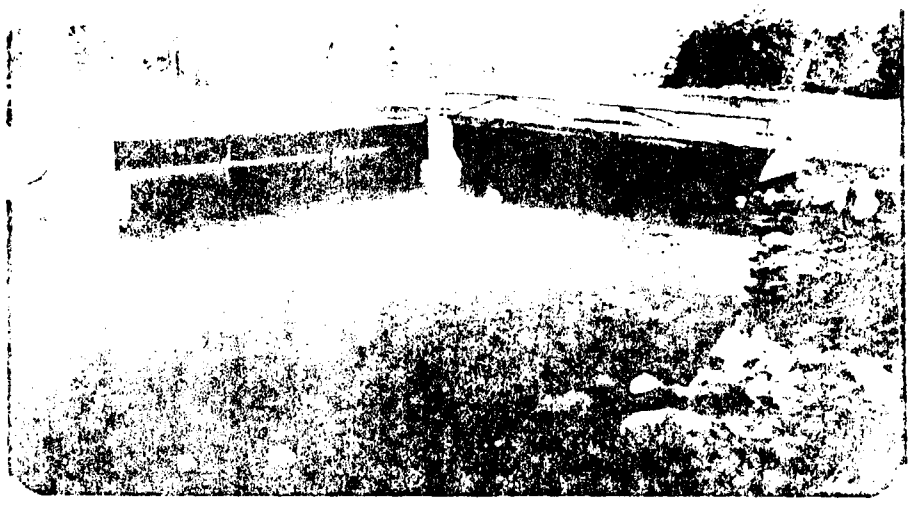
SCALE

DATE SEPT. 1978

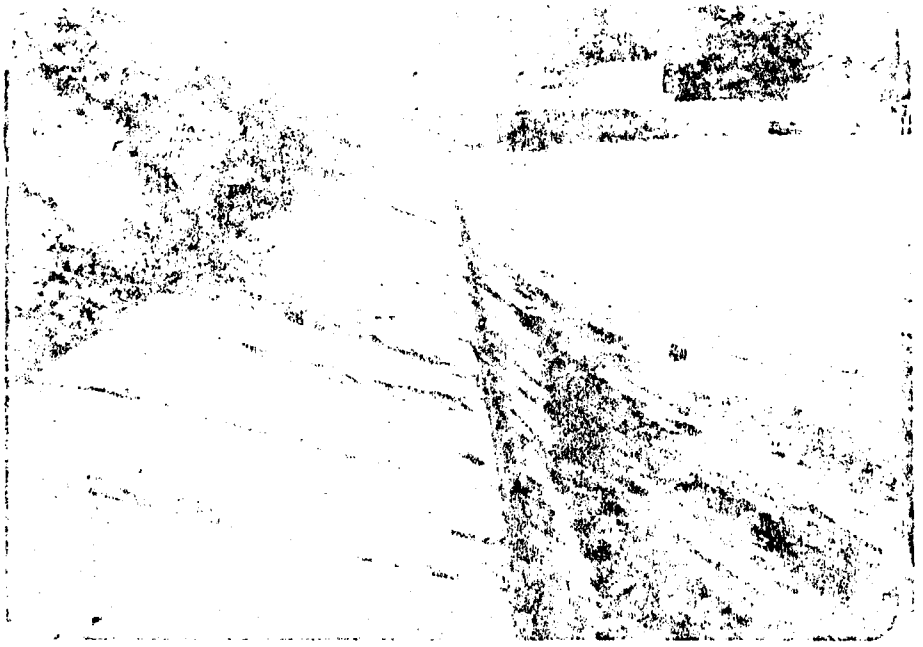
E
RIVER GATES INLET

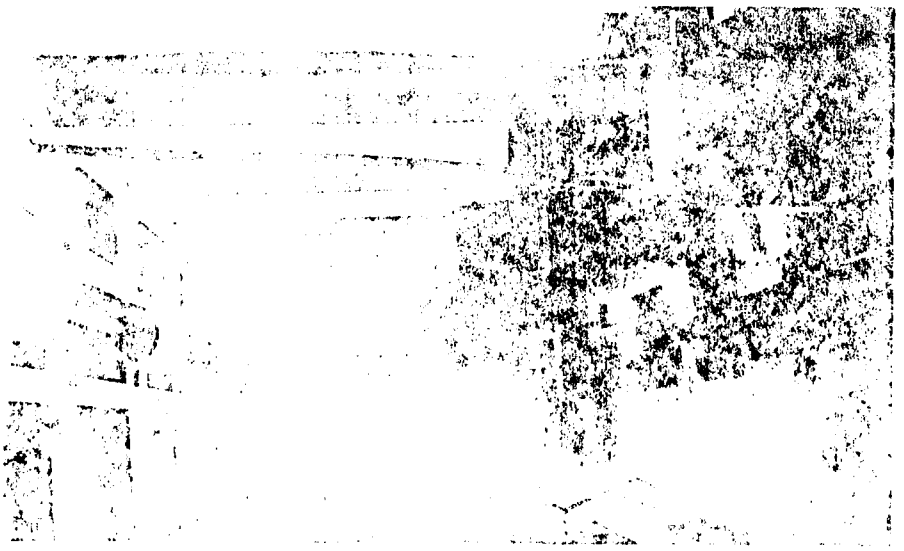


F



TRASH SCREEN ABOVE FINAL GATES



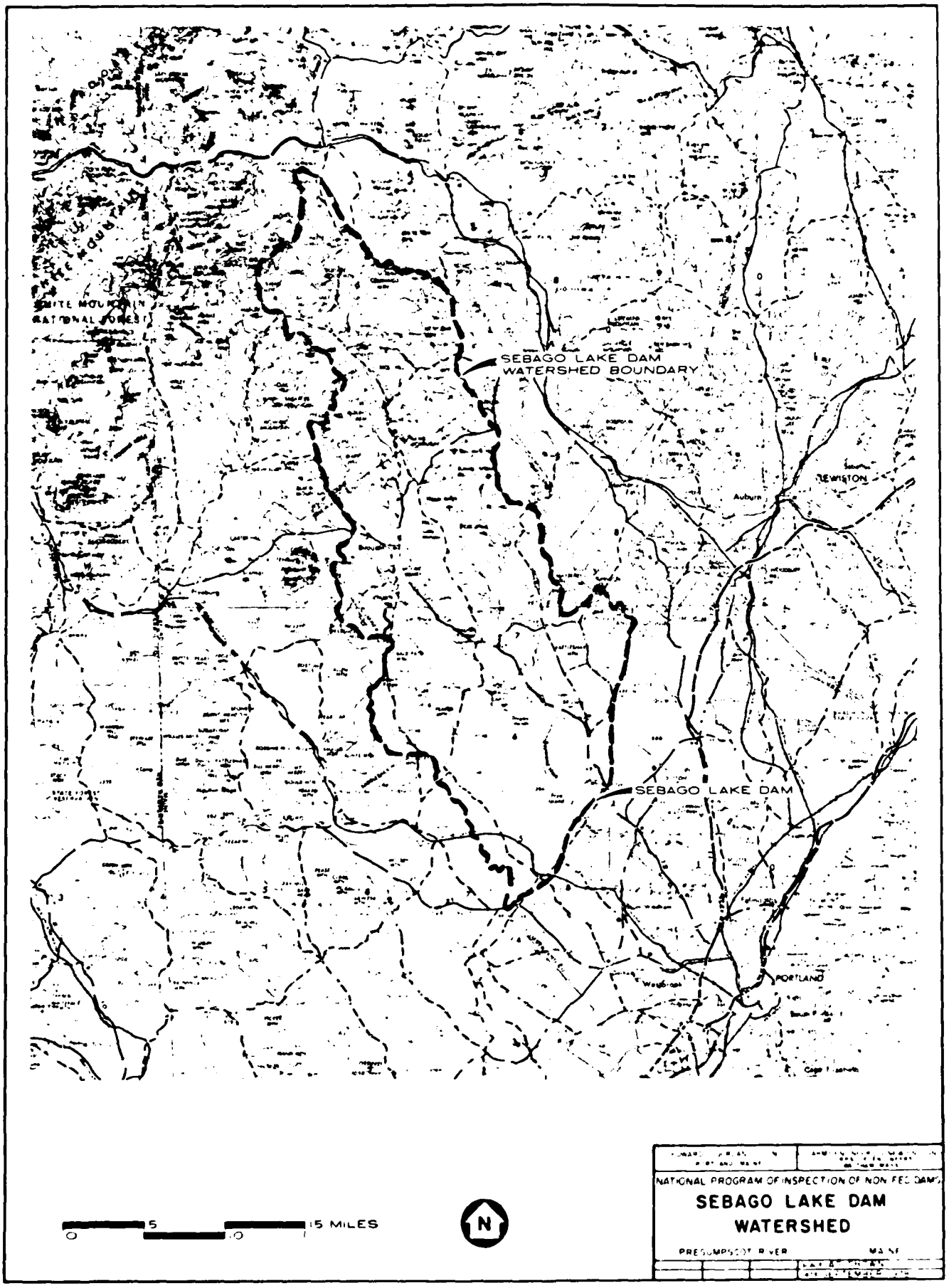


11
OLD CANAL GATE

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

Hydrologic computations pertinent to this investigation are attached. The following figure shows the Presumpscot River Watershed at Sebago Lake Dam.



NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

SEBAGO LAKE DAM
WATERSHED

PRESUMPSCOT RIVER — MAINE

Principal Assumptions and Analyses

No design data is available for Sebago Lake Dam. An analysis has been done which includes a hazard determination, estimation of full spillway discharge, and overtopping potential. In the event of sudden failure of the Sebago Lake Dam, the restriction at Whites Bridge would probably not reduce flood flow peaks. Tailwater rating curves are not available due to the lack of channel configuration data. However, there would appear to be adequate capacity since both the Eel Weir Canal and Presumpscot River drain flows from the dam. Flood flow discharges from Sebago Lake Dam were calculated by performing a log-Pearson Type III statistical analysis of the USGS gaging station No. 01064000 on the Presumpscot River at the outlet of Sebago Lake. Gaged lake levels at Whites Bridge on Sebago Lake were made available by the S. D. Warren Company for use in this report.

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
SEBAGO LAKE DAM DISCHARGE & STORAGE CURVES	BPD CHK BY	DATE 8-17-78

CREST = 268.65

CREST ELEV VOLUME = 47.7 sq mi

280' VOLUME = 62.31 sq. mi.

$\left(\frac{62.31 - 47.7}{280 - 268.65}\right) = 1.29$ sq mi/Ft of ELEVATION

Survey Datum ELEV	DISCHARGE w/o CANAL CFS	DISCHARGE w/ CANAL	STORAGE ACRE-FT
267		3467	
268.65	2385.20		0
269	2418.31	4747	10,357.92
270	2510.50	5222	41,022.32
271	2923.15	5970	73,272.39
272	3481.86	6831	107,108.14
273	5504.31	7959	142,529.56
274	8335.90	12219	179,536.66
275	10548.02	14672	210,942.56
276	14044.38	20316	258,307.90
277	20699.19	25267	300,072.02
278	25807.92	30553	343,421.83
279	31331.65	36305	388,357.31
280	37240.18	42403	434,878.47
281	43509.20		482,985.30
282	50118.54		532,677.81
283	57051.11		583,956.00
284	64292.20		636,819.86
285	71828.96		691,269.40
286	79650.01		747,304.62
287	87862.51		804,925.51
288	96341.98		864,132.05
289	105,229.31		924,924.32
290	114,350.03		987,302.24
268		4185	
266		2111	

FORM 101

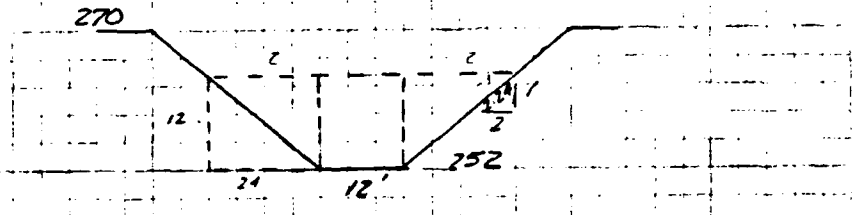
EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
SEBAGO LAKE DAM	JPD	70533-01
CANAL CAPACITY	CHK BY	DATE
	BTC	3-22-78

OVERFLOW WEIR CREST = 266.19
CANAL SIDESLOPES = 2:1

$Q = \frac{1.486}{.035} A R^{2/3} S^{1/2}$

$S = .0044$ ← Too high?



ELEV	A (FT^2)	P (FT)	R (FT)	$Q = \frac{1.486}{.035} A R^{2/3} S^{1/2}$ (CFS)	V fps
264	432.00	65.76	6.58	4299.05 CFS	9.95
264.5	462.50	68.00	6.80	4705.79	10.2
265	494.00	70.24	7.03	5140.31	10.4
265.5	526.50	72.48	7.26	5598.43	
266	560.00	74.72	7.49	6080.63	
266.19	572.99	75.57	7.58	6270.25	

FLOW OVER OVERFLOW WEIR

L = 89.5'

FROM TABLE 5-11, PG. 5-44, HANDBOOK OF HYDRAULICS, OBTAIN "C" VALUES FOR WEIR FLOWS.

WEIR CREST ELEVATION = 266.19

ASSUMED SLOPE S = 0.0044 must be too high. Earth canal would not support velocities of 10 fps +

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
SEBAGO LAKE DAM CANAL CAPACITY	EPD	20533-01
	CHK BY BTB	DATE 8-23-78

ELEV	C	Q = CLH$^{3/2}$	Q TOTAL
264	—		4299.05 CFS
264.5	—		4705.79
265	—		5140.31
265.5	—		5598.43
266	—		6080.63
266.19	0	0	6270.25
266.5	3.85	59.47	6329.72
267	3.85	251.20	6521.45
267.5	3.82	512.62	6782.87
268	3.79	826.00	7096.25
268.5	3.77	1184.63	7454.88
269	3.75	1580.93	7851.18
269.5	3.73	2010.36	8280.61
270	3.70	2462.70	8732.95

For Canal Gate flows: Estimate tailwater elev. to be at elev. of Eel weir.

FORM 191

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
SEBAGO LAKE DAM CANAL GATE FLOWS	BPD	20593-01
	CHK BY BTB	DATE 8-24-78

$Q = CA\sqrt{2gh}$ OVERFLOW WEIR = 266.19

ASSUME: (1) FREE DISCHARGE
(2) $C = .7$

AREA: $8'-10'' \times 7' \times 4 = 247.33\ ft^2$

Survey Datum Elevation	Head	$Q = CA\sqrt{2gh}$
266.19	—	—
268	1.81	1869.21
270	3.81	2711.94
272	5.81	3348.93
274	7.81	3832.78
276	9.81	4251.63
278	11.81	4774.66
280	13.81	5163.15
281	14.81	5346.82
282	15.81	5524.38
283	16.81	5696.42
284	17.81	5863.40
285	18.81	6025.76
286	19.81	6183.87
287	20.81	6338.02
288	21.81	6488.52
289	22.81	6635.60
290	23.81	6779.50
269	2.81	2329
271	4.81	3047
273	6.81	3625
275	8.81	4124
277	10.81	4568
279	12.81	4973
267	0.81	1250

FORM 101

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
SPILLWAY FLOWS	BPL	
	CHK BY	DATE
	LTB	8-11-78

$Q = CLH^{3/2}$ SLOPE = 2:1 CREST = .66
BASE ELEVATION = 270.12 L = 115.0'
FULL SPILLWAY ELEV = 272.62
Survey Datum

HEAD	ELEVATION	C	$Q = CLH^{3/2}$
0.5	270.72	3.41	139
1.0	271.12	3.41	392.15 CFS
1.5	271.72	3.57	754.23
2.0	272.12	3.65	1187.23
FULL → 2.5	272.72	3.70	1681.94
3.0	273.12	3.72	2222.91
3.5	273.72	3.73	2808.72
4.0	274.12	3.73	3431.60
4.5	274.72	3.73	4094.73
5.0	275.12	3.73	4795.81
6.0	276.12		6304.25
7.0	277.12		7944.27
8.0	278.12		9706.03
9.0	279.12		11581.65
10.0	280.12		13569.59
11.0	281.12		15669.83
12.0	282.12		17881.12
13.0	283.12		20205.82
14.0	284.12		22469.78
15.0	285.12		24919.74
16.0	286.12		27452.80
17.0	287.12		30066.30
18.0	288.12		32757.85
19.0	289.12		35525.29
20.0	290.12		38366.45
21.0	291.12		41279.61
22.0	292.12		44262.93
23.0	293.12		47314.95
24.0	294.12		50434.01
25.88 — 25.0	295.12 — 296	3.73	53618.75 — 56474.59
26.0	296.12	3.73	56867.83
27.0	297.12	3.73	60180.02
28.0	298.12	3.73	63554.12
29.38 — 29.0	299.12 — 299.50	3.73	66989.03 — 68310.01
30.0	300.12	3.73	70483.68

FORM 191

T.W. ELEVATION = 259.60'

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
RIVER GATES FLOW -		
	CHK BY PTL	DATE 8-11-78

$Q = CA\sqrt{2gh}$ MID GATE ELEV = 256.13'

ASSUME (1). FREE DISCHARGE
(2) C = 0.7

AREA: ACTUAL GATE DIMENSIONS 4'-9" x 6'-5"
ASSUME FLOW AREA = 4'-0" X 6'-0"

AREA = 24 FT² X 5 GATES = 120 FT²

HEAD	Survey Datum ELEVATION	C	$Q = CA\sqrt{2gh}$
1.0'	257.13	0.7	679.10 CFS
2.0	258.13	0.7	953.32
3.0	259.13	0.7	1167.57
4.0	260.13	0.7	1348.19
5.0	261.13	0.7	1507.33
6.0	262.13	0.7	1651.19
7.0	263.13	0.7	1783.49
8.0	264.13	0.7	1906.63
9.0	265.13	0.7	2022.29
10.0	266.13	0.7	2131.68
11.0	267.13	0.7	2235.73
12.0	268.13	0.7	2335.19
13.0	269.13	0.7	2430.49
14.0	270.13	0.7	2522.24
15.0	271.13	0.7	2610.77
15.83	271.96	0.7	2682.02
16.0	272.13	0.7	2696.39
17.0	273.13	0.7	2779.37
18.0	274.13	0.7	2859.95
19.0	275.13	0.7	2938.32
20.0	276.13	0.7	3014.65
21.0	277.13		3089.10
22.0	278.13		3161.79
23.0	279.13		3232.85
24.0	280.13		3302.39
25.0	281.13		3370.48
26.0	282.13		3437.23
27.0	283.13		3502.71
28.0	284.13		3566.98
29.0	285.13		3630.07
30.0	286.13	0.7	3692.18

F-DN 101

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
SEBAGO LAKE DAM RIVER GATE FLOWS CONT	BPD	20583-01
	CHK BY PTV	DATE 8/24/78

Survey Datum ELEVATION	HEAD	$Q = CA\sqrt{2gh}$
286	29.87	3684.17
287	30.87	3745.33
288	31.87	3805.51
289	32.87	3864.76
290	33.87	3923.10
291	34.87	3980.60
292	35.87	4037.27
293	36.87	4093.16
294	37.87	4148.30
295	38.87	4202.71

FORM 101

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
DOWNSTREAM DAM FAILURE HYDROGRAPHS	BTD	20583 01
	CHK BY	DATE
		9-11-78

Width between abutments ≅ 360'

Most Likely Location for breaching of dam is north of north abutment in earth embankment.

$W_b = 0.4(360) = 144'$ {Whites Bridge Opening = 157.5'}

$Y_o = 268.4 - 248.0 = 20.4'$

$$Q_{p2} = \frac{8}{27} W_b \sqrt{g} Y_o^{3/2}$$

$$Q_{p2} = \frac{8}{27} (144)(\sqrt{g})(20.4)^{3/2} = 22{,}310 \text{ CFS}$$

Reservoir Storage @ Crest = 329,500 Ac-Ft

Reservoir Storage @ full Spillway:

S = 381,500 Ac-Ft

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
SEBAGO LAKE STORAGE CONT.	BTL	20583 01
	CHK BY	DATE
		9-8-78

ASSUMING:

Normal Storage = 223,000 Ac-Ft

Normal Water Surface = 263.5

Max. Water Surface @ Spillway Crest Elev. = 266.65

1.29 Sq Mi/Ft of height = Increase in Lake Area Above normal pool

Increment Flood Storage: {Legal High Water 267.15}

H = 267.15 − 263.5 = 3.65

$S = (3.65)\left(45.6 + \frac{1.29(3.65)}{2}\right)\left(640 \frac{Ac}{Sq\ Mi}\right) = 117{,}500\ Ac\text{-}Ft$

∴ FLOOD STORAGE = 340,000 Ac-Ft

MAXIMUM STORAGE (Elev. 268.4):

1.29 mi/Ft of height above normal pool

∴ Increased Area = (268.4 − 263.5) 1.29

= 6.3 Sq Mi

S = 340,000 + 1.25 (45.6 + 6.3)(640)

S = 381,500.

FORM 101

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
STORAGE FOR SEBAGO LAKE	DTB	20563 01
	CHK BY	DATE
		9-F-78

FROM C.O.E INVENTORY SHEET:

Normal Storage = 223,000 Ac-Ft

Maximum Storage = 249,700 Ac-Ft

ΔS = 26,700 Ac-Ft

LAKE AREA = 45.6 Sq Mi

$$\Delta H = \frac{26,700}{45.6\,(640)} = 0.91'$$

FROM USGS:

Usable Capacity = 11,000,000,000 CuFt

or 252,525 Ac-Ft

Ave Annual High Water Surface Elev = 265.5'

Ave Water Surface Elev. (May) = 264.F

USGS Quad Water Surface = 267.0'

based on S.D. Warren Datum which is 3.47' higher than MSL

FROM SURVEY:

Spillway Crest = 266.65'

Top of Dam = 268.43'

FORM 101

COMPILED EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
SUMMARY TABLE	BTB	20583 01
	CHK BY	DATE 8-30-78

Recurrence Interval yrs	Outflow cfs	Survey Datum & S.D. Warren Datum Elevation	Height above MSL Elevation
10	2700	266.4*	262.93*
25	3823	267.4	264.03
50	4F70	269.26	265.79
100	6126	271.18	267.71
200	7635	272.35	268.88
500	10100	273.31	269.84
MPF	91,500 → 27,260	277.37	273.9

*Assumes Canal Gates Closed

1902 Flood = 7000 cfs

1936 Flood = 3790 cfs @ 268.13[1]

1928 Flood = 2370 cfs @ 267.3

[1] According to USGS 267.7 is the highest elevation to have occurred, and has occurred 3 times.

FORM 101

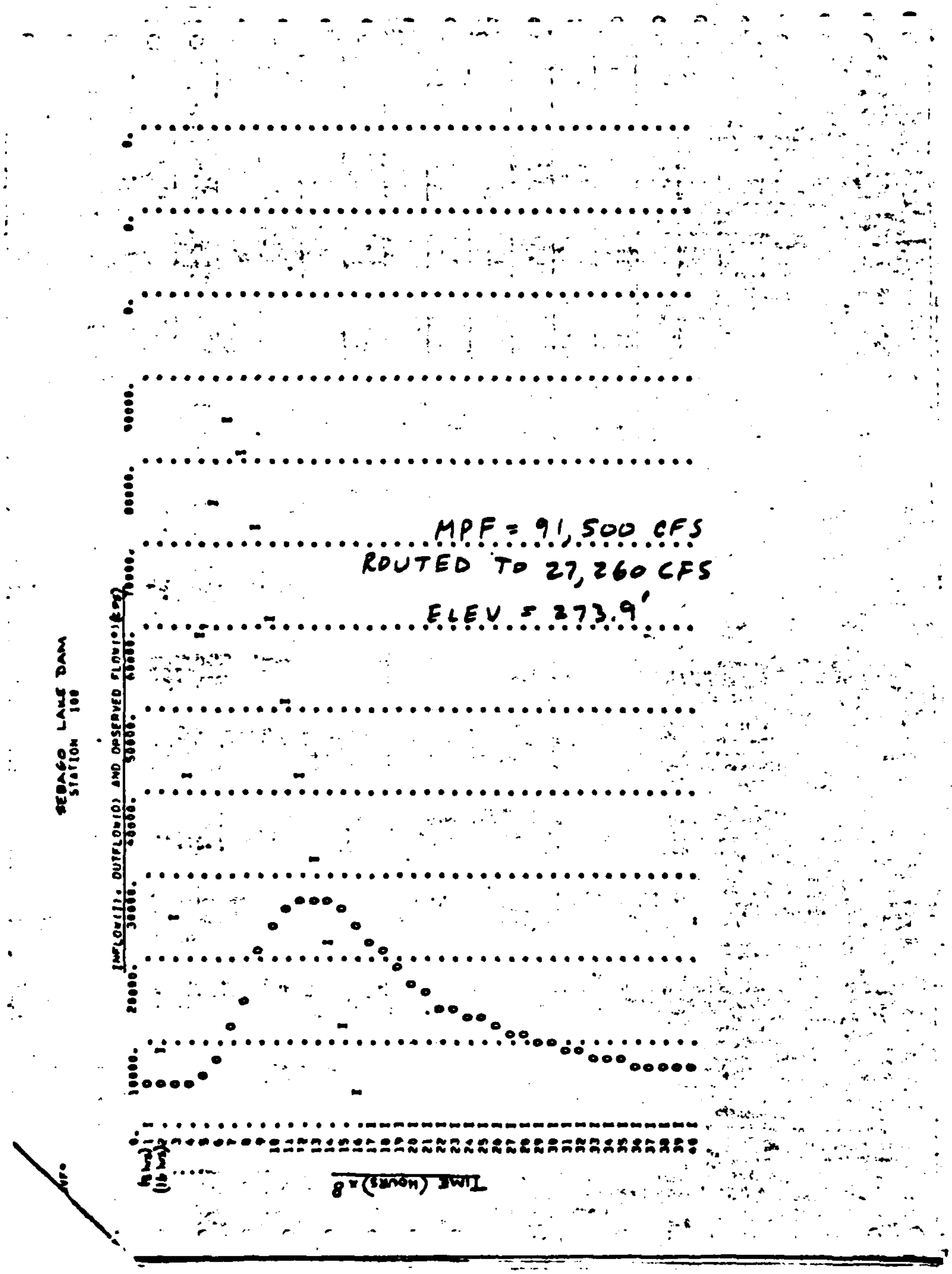
EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
SUMMARY TABLE	BTB	20583 01
	CHK BY	DATE 8-30-78

Flood Date	Recorded Outflow cfs	Recorded Water Surface Elevation	Calculated Water Surface Elevation	Estimated Recurrence Interval, yrs.
1936	3790	268.13	267.45	25
1952	3620	267.1	267.21	25
1953	3420	267.1	266.97	20
1960	3420	267.1	266.97	20
1973	3290	?		20
1922	3210	267.5	266.81	20
1951	3160	267.0	266.77	20
1926	2370	267.3		10
1902	≈7000	267.7		200

Average Annual Peak Water Surface Elevation for the past 100+ years = 265.5

FORM 101


SEBAGO LAKE DAM
STATION 100
INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)(cfs)
10000.
20000.
30000.
40000.
50000.
60000.
TIME (HOURS) x 8
MPF = 91,500 CFS
ROUTED TO 27,260 CFS
ELEV = 273.9'

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
SEBAGO LAKE DAM HYDROGRAPH	BPD	
	CHK BY PJT	DATE 8-16-78

VOLUME = 19" NPF = 91,560 CFS = h

DRAINAGE AREA = 436 MI²

$\frac{1}{2}bh = \left(\frac{19}{12}\right)(436\ mi^2)\left(\frac{5280\ FT}{MI}\right)^2$

b = 420388.57 SEC.

= 116.775 HRS.

420388.57 = 2.67 T_c

T_c = 157446.90 SEC

= 43.74 HRS.

FORM 171

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
MAXIMUM PROBABLE FLOOD	BFD	
	CHK BY BTB	DATE 8-11-78

FLAT & COASTAL

MAX. PROBABLE FLOOD = ~~240~~ 210 CFS / SQ MILE

DRAINAGE AREA = 436 mi^2

MPF = $(436)(210)$ = ~~102,360~~ 91,560 CFS

DETERMINE PEAK OUTFLOW: 287 before routing

MAX. ELEV. APPROX = 299.50

MAX. Q IN CFS = 212,785.22 CFS
(W/O CANAL GATES)

ASSUME CANAL GATES WILL PASS 9574.78 CFS

TOTAL = ~~222,360~~ CFS

Q_{P_1} = ~~222,360~~ 91,560 CFS

ARE DAM ELEV = 272.24

SURCHARGE HEIGHT = 299.50 − 272.24 = 27.26'

$STOR_1$ =

$STOR_1 = (27.26 ft)(97.70\ mi^2)\left(\frac{5280\ ft}{mi}\right)^2 \times \frac{1\ acre}{43560\ ft^2}$

= ~~832,993.28~~ 450,583.28 ACRE-FT

$$\frac{(436\ mi^2)\left(\frac{5280\ ft}{mi}\right)^2\left(\frac{1\ acre}{43560\ ft^2}\right)}{\times 12\ in/ft} = 2.98\ ft$$

~~19.35~~ Greater than 19"!

∴ USE HEC-I ROUTING

FORM 101

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
SEBAGO LAKE DAM WIER 5 FLOW OVER CANAL GATES	BPD	20583-01
	CHK BY	DATE
	PJH	8-27-78

$Q = CLH^{3/2}$ $C = 2.63$ Top Elev = 285.79
Length = 40.5'

ASSUME: HOUSE WILL ACT AS A BROAD CRESTED WIER WHEN THE LAKE LEVEL REACHES THE TOP OF IT.

Survey Datum

ELEVATION	HEAD	$Q = CLH^{3/2}$
285.79	0	0
286	.21	10.25
288	2.21	349.94
290	4.21	920.10
292	6.21	1648.35
294	8.21	2505.63
296	10.21	3474.96
298	12.21	4544.48
300	16.21	5705.61

FORM 101

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
RIVER GATE FLOWS (WIER A)	BPD	
	CHK BY: BTB	DATE: 8-15-78

$Q = CLH^{3/2}$ $C = 2.63$ TOP ELEV = 285.79' LENGTH = 33.5'

ASSUME THAT HOUSE WILL ACT AS A BROAD CRESTED WIER WHEN THE LAKE LEVEL REACHES THE TOP OF IT.

HEAD	Survey Datum ELEVATION	C	$Q = CLH^{3/2}$
-.5	286.79	2.63	31.15 CFS
1.0	286.79	2.63	88.11
2.0	287.79	2.63	249.20
3.0	288.79	2.63	457.81
4.0	289.79	2.63	704.84
5.0	290.79	2.63	985.04
6.0	291.79	2.63	1294.87
7.0	292.79	2.63	1631.73
8.0	293.79	2.63	1993.59
9.0	294.79	2.63	2378.84
10.21 — 10.0	295.79	2.63	2786.12 — 2874.35
11.0	296.79	2.63	3214.32
12.0	297.79	2.63	3662.46
13.11 — 13.0	298.79 EL 298.79	2.63	4129.67 — 4472.57
14.0	299.79	2.63	4615.22
15.0	300.79	2.63	5118.44

FORM 101

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
FLOWS OVER DAM (WIER 3) SECTION TO LT OF CANAL GATE	BPD	
	CHK BY PTL	DATE 8-11-78

$Q = CLH^{3/2}$

TOP ELEV = 271.90
LENGTH = 117

ASSUME (1) BROAD CRESTED WIER
(2) C = 2.63

HEAD	Survey Datum ELEVATION	C	$Q = CLH^{3/2}$	
.5	272.40	2.63	108.79 CFS	
1.0	272.90	2.63	307.71	
1.5	273.40	263	565.30	
2.0	273.90	2.63	870.34	
2.5	274.90	2.63	1216.33	
3.0	274.90	2.63	1598.91	
3.5	275.40	2.63	2014.85	
4.0	275.90	2.63	2461.68	
4.5	276.40	2.63	2937.38	
5.0	276.90	2.63	3440.30	
5.5	277.40	2.63	3969.04	
6.0	277.90	2.63	4522.39	
7.0	278.90		5698.87	
8.0	279.90		6962.68	
9.0	280.90		8308.17	
10.0	281.90		9730.64	
11.0	282.90		11226.19	
12.0	283.90		12791.26	
13.0	284.90		14423.03	
14.0	285.90		16118.84	
15.0	286.90		17876.39	
16.0	287.90		19693.44	
17.0	288.90		21568.25	
18.0	289.90		23499.05	
19.0	290.90		25484.26	
20.0	291.90		27522.42	
21.0	292.90		29612.19	
22.0	293.90		31752.33	
23.0	294.90		33941.68	
24.10 — 24.0	295.90 — 296		36179.16 — 36405.57	
25.0	296.90	2.63	38463.75	
26.0	297.90	2.63	40794.50	
27.0 — 27.0	298.90 — 299.5	2.63	43170.52 — 44617.50	
28.0	299.90	2.63	45590.95	
29.0	300.90	2.63	48053.00	

FORM 101

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
FLOWS OVER DAM (NEC 2) SECTION TO RT. OF CANAL GATE	BTD	
	CHK BY BTD	DATE 8-14-78

$Q = CLH^{3/2}$

TOP ELEVATION = 271.96
LENGTH = 63'

ASSUME (1) BROAD CRESTED WIER
(2) C = 2.63

Survey Datum

HEAD	ELEVATION	C	$Q = CLH^{3/2}$
0.5	272.46	2.63	58.58 CFS
1.0	272.96	2.63	165.69
1.5	273.46	2.63	304.39
2.0	273.96	2.63	468.64
2.5	274.46	2.63	654.95
3.0	274.96	2.63	860.95
3.5	275.46	2.63	1084.92
4.0	275.96	2.63	1325.52
4.5	276.96	2.63	1581.67
5.0	276.96	2.63	1852.97
5.5	277.46	2.63	2137.18
6.0	277.96	2.63	2435.14
6.5	278.46		2745.78
7.0	278.96		3068.62
8.0	279.96		3749.19
9.0	280.96		4473.63
10.0	281.96		5239.58
11.0	282.96		6044.85
12.0	283.96		6887.60
13.0	284.96		7766.25
14.0	285.96		8679.37
15.0	286.96		9625.72
16.0	287.96		10604.16
17.0	288.96		11613.68
18.0	289.96		12653.34
19.0	290.96		13722.29
20.0	291.96		14819.76
21.0	292.96		15945.03
22.0	293.96		17097.41
23.0	294.96		18276.29
24.0	295.96		19481.09
25.0	296.96	2.63	20711.25
26.0	297.96	2.63	21966.27
27.0	298.96	2.63	23245.66
28.0	299.96	2.63	24548.97
29.0	300.96	2.63	25875.77

296 — 299.5

24.04 — 19529.81

27.54 — 23946.51

FORM 101

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
FLOWS OVER DAM SECTION TO RT. OF SPILLWAY	EPD	
	CHK BY PTE	DATE 8-14-78

HEAD	Survey Datum ELEVATION	C	$Q = CLH^{3/2}$
17.5	290.12	2.63	35619.23
18.0	290.62		37156.62
19.0	291.62		40295.62
20.0	292.62		43518.36
21.0	293.62		46822.70
22.0	294.62		50206.68
23.38 23.0	295.62 296		53668.47 – 55004.00
24.0	296.62		57206.36
25.0	297.62	2.63	60818.75
26.88 26.0	298.62 2995	2.63	64504.13 – 67806.51
27.0	299.62	2.63	68261.07
28.0	300.62	2.63	72088.26

Form 101

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
FLOWS OVER DAM (WEIR) SECTION TO RT OF SPILLWAY	BPD	
	CHK BY	DATE
	[illegible]	8-19-78

$Q = CLH^{3/2}$

TOP ELEVATION = 272.62
LENGTH = 185'

ASSUME (1) BROAD CRESTED WIER
(2) C = 2.63

Survey Datum

HEAD	ELEVATION	C	$Q = CLH^{3/2}$
0.5	273.12	2.63	172.02 CFS
1.0	273.62	2.63	486.55
1.5	274.12	2.63	893.85
2.0	274.62	2.63	1376.17
2.5	275.12	2.63	1923.26
3.0	275.62	2.63	2528.19
3.5	276.12	2.63	3185.88
4.0	276.62	2.63	3892.40
4.5	277.12	2.63	4644.58
5.0	277.62	2.63	5439.79
5.5	278.12	2.63	6275.83
6.0	278.62	2.63	7150.80
6.5	279.12		8063.02
7.0	279.62		9011.03
7.5	280.12		9993.54
8.0	280.62		11009.37
8.5	281.12		12057.06
9.0	281.62		13136.85
9.5	282.12		14246.65
10.0	282.62		15386.06
10.5	283.12		16554.32
11.0	283.62		17750.74
11.5	284.12		18974.67
12.0	284.62		20225.50
12.5	285.12		21502.68
13.0	285.62		22805.65
13.5	286.12		24133.93
14.0	286.62		25487.05
14.5	287.12	2.63	26864.59
15.0	287.62	2.63	28266.00
15.5	288.12	2.63	29691.01
16.0	288.62	2.63	31139.20
16.5	289.12	2.63	32610.19
17.0	288.62	2.63	34103.65

FORM 101

EDWARD C. JORDAN CO., INC.

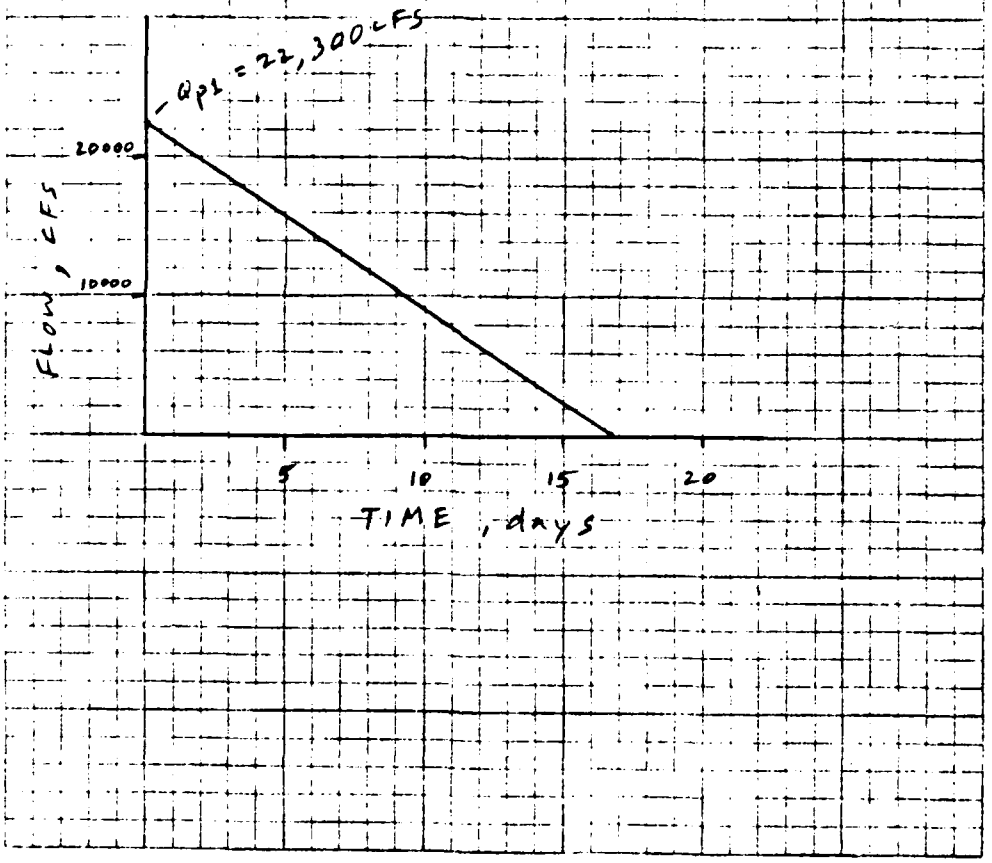
PROJECT	COMP BY	JOB NO.
FAILURE HYDROGRAPH	BTB	2658301
	CHK BY	DATE
		9-11-78

$\frac{1}{2} Q_p T = 12.1 S$

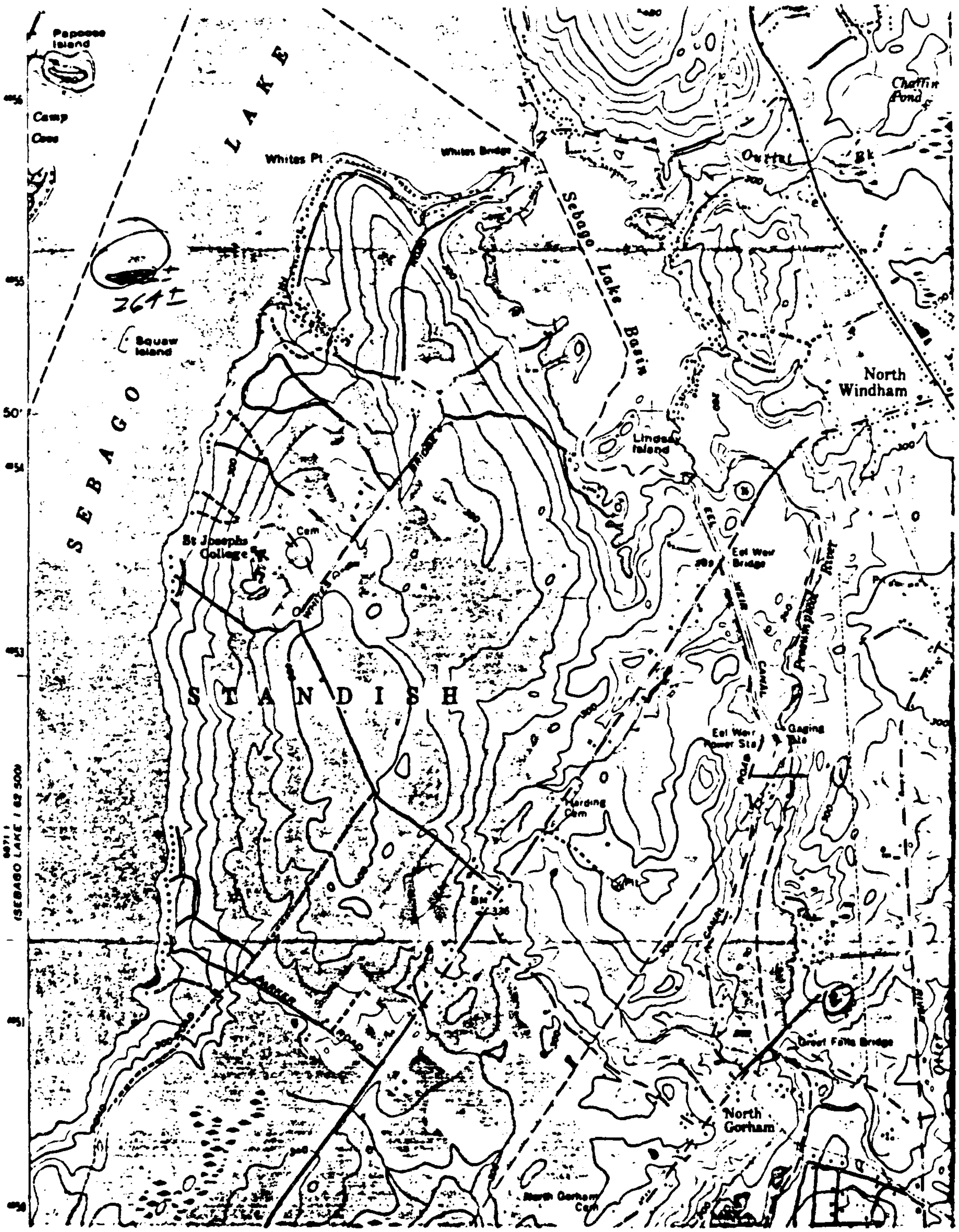
$\frac{1}{2} (22,370)(T) = 12.1 (367,300)$

$T = 398.5$ hrs

or 16.6 days

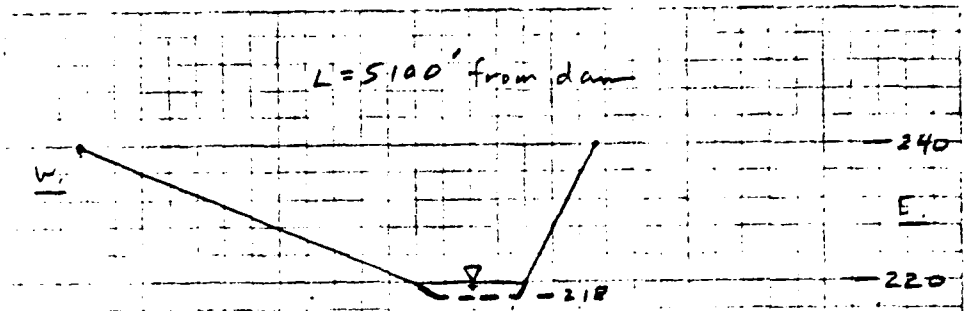


FORM 101


Papoose Island
Camp Cove
SEBAGO LAKE
Whites Pt
Whites Bridge
Sebago Lake Basin
Chaffin Pond
Outlet Bk
264±
Squaw Island
50'
North Windham
Lindsay Island
St Josephs College
Cem
STANDISH
Eel Weir Bridge
Presumpscot River
Eel Weir Power Sta
Gaging Sta
Harding Cem
Great Falls Bridge
North Gorham
North Gorham Cem

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
RATING CURVE @ SECTION D - 700' downstream of existing Station	LTD	205F3 01
	CHK BY	DATE
	[illegible]	9-11-78



$n = 0.035$ Channel $S = 0.0033$

$n = 0.07$ overbank

$Q = \frac{1.4}{n} A R^{2/3} S^{1/2}$

ELEV.	Area	FLOW	$L \times A = V$ VOLUME OF STORAGE Ac-Ft
220	360	1369	142
225	1635	11678	191
230	3660	29433	428
228	2760	21960	323

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
DOWNSTREAM DAM FAILURE HYDROGRAPHS	BTB	20583 01
	CHK BY	DATE 9-11-78

$Q_{p2} = 22,310$ CFS

$V_1 = 328$ Ac-FT

$Q_2\,(TRIAL) = 22310\left(1 - \frac{328}{367,400}\right) \approx 0$

$Q_2 = 22,310$ { INSIGNIFICANT ROUTING EFFECT }

STAGE $\approx$ 228 @ INLET TO GREAT FALLS POND

FORM 101

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
ESTIMATE OF DOWNSTREAM VALLEY STORAGE	BTB	205F3 01
	CHK BY	DATE
		9-11-78

STORAGE IN FIRST 5100' = 328 Ac-Ft

FLOOD PLAIN APPEARS TO BE ABOUT THE SAME WIDTH FROM SECTION ⑩ TO WESTBROOK (CITY PROPER)

LENTH OF CHANNEL TO CUMBERLAND ST. IN WESTBROOK = 80,000 FEET

$$\frac{328 \text{ Ac-Ft}}{5100'} = \frac{V}{80000}$$

Valley Storage $V = 5145$ Ac-Ft

$$\text{Routing Factor} = \left(1 - \frac{V}{S}\right)$$

$$\text{Factor} = 1 - \frac{5145}{381{,}500} = 0.99$$

∴ Valley Routing Effect Insignificant

FORM 101

FROM: GRANT KELLY - C.O.E 9-12-78

WESTBROOK, ME FLOOD STUDY
DRAFT COMPLETE ~ 6 WEEKS AGO

500 YEAR FLOW:

@ CUMBERLAND MILLS DAM = 17,000 CFS

@ WESTBROOK-FALMOUTH LINE = 18,600 CFS

LOCATION	ELEVATION	FLOOD PLAIN WIDTH, ft.
Upstream Corp. Limits	78	1000
Bridge St.	52	1200
RR Bridge	48	200
Cumberland St.	46	400
Riverton St.	40	800
Downstream Corp. Limits	39	1100

EDWARD C. JORDAN CO., INC.

PROJECT	COMP BY	JOB NO.
DOWNSTREAM DAM FAILURE PROBLEM	RTB	2C5E3 01
	CHK BY	DATE
		9-12-78

According to the triangular hydrograph that was constructed, Sebago Lake would take 16+ days to drain the usable storage through the breach width. Therefore substantial flows would continue for several days.

Damage in Westbrook, then, may be assumed to be similar to that incurred during the 500 year flood. Substantial damage would also, therefore, occur in Windham upstream from Westbrook.

FORM 191

APPENDIX E

INVENTORY FORMS

Inventory forms are attached to this section.

END

FILMED

8-85

DTIC